CHAPTER-5
Factors Determining the Rental Rates of Agricultural Capital Goods

5.1 Preliminary analysis in the previous chapter has shown the presence of variations of rental rates of ploughing machineries across farm households as well as villages. The third objective of the present study is to examine the rental rate structure of machineries and the determinants of the rental rates. The first part of this objective, i.e. rental rate structure has already been discussed in the previous chapter in section 4.4.3. So, this chapter deals with the factors affecting the rental rates of power tiller, ploughing tractor and ploughing cum leveller tractor.

Discussion on rental rate structure of ploughing machinery reveals the variation of average rental rates across villages with respect to ploughing cum leveller tractors and power tillers. But, variation of average rental rates of ploughing tractor is observed across some villages. Moreover, rental rates paid by the households are not same for all households. During the field study it was reported by some of the respondents that the variation of rental rates of ploughing machinery at household level is mainly influenced by-(a) distance from the home of lender of implements to the farm land to be ploughed, (b) relation of the hirer with the lender of the capital goods, (c) membership of farmer groups acting as lessor of concerned machinery and (d) fuel price. In other words, the above cited factors are the basic determinants of rental rates of ploughing machinery as reported. In following sections, attempt has been made to find out the actual determinants of rental rates of different ploughing machineries.

5.2 Power Tiller
Study about the factors affecting rental rates of agricultural capital goods has been done in two parts. Firstly, presence of any difference of rental rates in terms factors like relation of hirer with lender of such goods, distance from the home of lender of implement to the farm land
to be ploughed, membership of farmer groups acting as lessor of concerned machinery has been examined using simple statistical tools and impact of monopoly power of lessor on rental rate has been examined using only econometric tools. Distance from the home of lender of implement to the farm land to be ploughed has been captured in terms of sources of hiring-in. Finally, the impression obtained from initial discussion has been ascertained with the help of econometrics tools. In terms of relationship between hirer and lender of capital goods, hirers have been divided in to two groups- hirers from relative/friend and open market hirers. Hirers from other than relative/friend are included in the group of open market hirers. Similarly, in terms of sources of hiring-in, hirers have been classified as- hiring-in from within village sources and hiring-in from outside village sources. Again, on the basis of membership of farmer group involving in leasing-out of concerned machinery, lessees are divided in to two groups namely as members and non-members. Same classification has been followed in succeeding discussions also. However, in terms of fuel prices, presence of any difference of rental rates has not been examined. This is because as a farmer may hire-in same ploughing machinery at different points of time while fuel prices at different points of time are not same, it is difficult to get information about exact time of hiring-in along with fuel price of concerned machinery at that point of time. This is a limitation of the study. 

Figure-5.1(a) depicts that average rental rate paid by hirers from relative/friend is Rs.214.44 bigha/round against Rs.248.98 bigha/round paid by hirers from open market. Thus we have got an impression that in terms of relation, hiring-in from relative/friend is beneficial than from open market lessors. In terms of membership of farmer groups involving in leasing-out of power tiller time, it is found that a group member pays lower rental rate than a non-member which is clear from figure-5.1 (b). However, in terms of sources of hiring-in, the picture reflected by figure-5.1(c.i) is contrary to our anticipation. Hirers of power tiller from source(s) within village on an average pay Rs.246.55
bigha/round while hirers from source(s) outside village pay Rs.242.86 bigha/round. To see whether this unexpected result in terms of sources of hiring-in is influenced by other variables, we have decomposed the analysis at location level.

Figure-5.1 (c.ii) reveals that contrary to the impression given by figure-5.1(c.i), average rental rate of power tiller paid by hirers from outside village source(s) is higher than that of paid by hirers from within village source(s) in North Lakhimpur and Kamrup. However, in Morigaon, on an average, hirers from lessors in outside village pay lower rental rates.
than hirers from lessors in within village. But examination of data shows that in Morigaon only one hirer hiring-in power tiller from outside village and he/she was relative/friend of the lessor. Thus, the impression derived from above discussion is that factors like distance from the home of lender of implements to the farm land to be ploughed, social contact between lessee and lessor affects rental rate of power tiller. Now to ascertain this impression we have developed the following regression model.

**Dependent Variable**
Unit of rental rate per bigha\(^{11}\) per round (Y)

**Independent Variables**

*Sources of Hiring-in (SOH):* Distance from the home of owner of implement to the farm land to be ploughed has been captured in terms of sources of hiring-in. we have divided sources of hiring-in as within village and outside village. Hence, SOH is a dummy where SOH is 1 if source is within village and SOH is 0 otherwise.

Long distance movement of power tiller consumes more amount of fuel. So, we can expect that longer is the distance, higher is the rental rate.

*Relation with the Owner of Capital Goods (RWCG):* RWCG is a dummy where RWCG=1 if hiring-in is from friend/relative, otherwise RWCG=0. A close relation between lessee and lessor generally suppresses the rental rates. So, it can be expected that the rental rate is higher in case of open market hiring-in than the hiring-in from relative/friend.

*Monopoly Power of the Supplier (MPOWR):* Monopoly power has been measured as a ratio of lessees to lessors. Here suppliers and demanders within the villages are considered. However, in Bihubori village two power tillers are being found to be supplied by a farmer group functioning there. That group has been considered as one lessor in calculation of the monopoly power of the suppliers as controlling unit is one although they have been supplying two power tillers. Higher is

\(^{11}\) Bigha is a common unit of land use in Assam and 1 bigha is equal to 0.13387 hectare
the value of the variable, more is the monopoly power. However, this variable is not a perfect variable to capture the market power. As more monopoly power implies less competition, and so supplier have more control over the rental rate of the capital goods, a positive sign of the variable can be anticipated.

**Membership of farmer group (MFG):** MFG is a dummy with 1 for group members and 0 otherwise. If a lessee, being the member of the group leasing-out power tiller times, hires in power tiller times from that group, rental rate is likely to be lower than that paid by a non-member lessee. So, we can expect a negative sign of this variable.

**Location Characteristics:** Location of the present study covers three districts. Extent of use of power tiller due to various reasons and the rental markets arrangement may vary across locations and so the rental rate too. Therefore, two dummies, \( L_1 \) and \( L_2 \) have been used taking North Lakhimpur as base category where, \( L_1=1 \) for Morigaon, 0 otherwise and \( L_2=1 \) for Kamrup, 0 otherwise.

Now taking unit of rental rate per bigha as the dependent variable, the formulation of the model is done as follows-

\[
Y = F (SOH, RWCG, MPOWR, MFG, L_1, L_2) \quad \text{(5.01)}
\]

**Functional Specification of the Model**

In the model dependent variable can take only positive values. In such case if we use simple linear regression model, there is no guarantee that all predicted values will be positive. Hence, an exponential specification of the regression model will be suitable. Accordingly, an exponential specification of the formulation (5.01) has been constructed as follows-

\[
Y_i = \exp(\beta_0 + \beta_1 SOH_i + \beta_2 RWCG_i + \beta_3 MPOWR_i + \beta_4 MFG_i + \beta_5 L_1i + \beta_6 L_2i + U_i) \quad \text{(5.02)}
\]

Since formulation-5.02 is non-linear, before estimating, formulation is made linear by taking log on both sides.
Thus,

\[ \text{Ln}Y_i = \beta_0 + \beta_1 \text{SOH}_i + \beta_2 \text{RWCG}_i + \beta_3 \text{MPOWR}_i + \beta_4 \text{MFG}_i + \beta_5 L_{1i} + \beta_6 L_{2i} + U_i. \] ................................. (5.03)

Here \( U_i \) is the disturbance term which is assumed to be distributed normally.

Using STATA 11 ordinary least square estimates of the parameters have been obtained. Before estimating the parameters, presence of the problem of heteroscedasticity has been examined applying Breusch-Pagan test as data set is come from cross section sample. Result shows that problem of heteroscedasticity is not present.

**Table-5.1: Results of Log-Linear Regression for Determinants of Rental Rate of Power Tiller**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Estimates of coefficients/values</th>
<th>Standard errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOH</td>
<td>0.06</td>
<td>0.05</td>
</tr>
<tr>
<td>RWCG</td>
<td>-0.16***</td>
<td>0.04</td>
</tr>
<tr>
<td>MPOWR</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>MFG</td>
<td>-0.19***</td>
<td>0.06</td>
</tr>
<tr>
<td>L_{1}</td>
<td>0.12***</td>
<td>0.03</td>
</tr>
<tr>
<td>L_{2}</td>
<td>0.007</td>
<td>0.04</td>
</tr>
<tr>
<td>Constant</td>
<td>5.38***</td>
<td>0.07</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>F(6, 110)</td>
<td>6.07***</td>
<td></td>
</tr>
</tbody>
</table>

In () degrees of freedom
*** Represents significant at 1%

Table-5.1 shows the results of the regression model for determinants of rental rate of power tiller. Result shows that \( F \)-value is highly significant. Significance of \( F \)-value specks the relevance of explanatory variables in explaining dependent variable. It is found that RWCG is negatively significant at 1 percent. It confirmed the impression that relationship between lessor and lessee is a crucial determinant of rental rate of power tiller. In other word, a close relation between lessee and lessor helps in hiring-in power tiller comparatively at a lower rental rate. Another variable MFG is also found to be negatively significant at 1 percent. It implies that hiring-in of power tiller from a group leasing out such machinery times is cheaper for the lessees.
having membership of that group than the non-members. SOH is not significant which implies that distance from the lessor’s home to the land to be ploughed has no role in determination of rental rate of power tiller. MPOWR is also not significant which means that market power has no role in the determination of rental rate of power tiller time. L1 is positively significant at 1 percent revealing that rental rate of power tiller in Morigaon is significantly higher than base category North Lakhimpur. L2 is not significant which means that there is no such difference between the rental rates of power tillers in Kamrup and that of in North Lakhimpur. Further, constant term is found to be positively significant at 1 percent.

5.3 Ploughing Tractor

At the outset it is to be mentioned here that among the hiring-in households one of them (2.94 percent) hired in ploughing tractor from multiple sources. We have excluded that household in this section of analysis due to technical problem and at the same time that household also consists of a negligible portion of total hiring-in households.

In case of rental market of ploughing tractor, in terms of relation between the lessor and lessee, hirer farmers from relative/friend on an average pays lower rental rate (Rs.161.43 per bigha per round) than the
open market hirers (Rs.237.78 per bigha per round) as depicted by figure-5.2(a). Thus it is found that nature of relationship between lessor and lessee may have a significant role in deciding rental rate of ploughing tractor. Again, in terms of sources of hiring-in, lessee from within village source(s) on an average pays lower rental rate (Rs.214.44 per bigha per round) than the lessee from outside village source(s). Thus the impression got is that distance from lessor’s home to the land to be ploughed and relation between lessee and lessor has some impacts of the rental rate of ploughing tractor. Let us follow the second approach to confirm the above derived impression with regards to determinants of rental rate of ploughing tractor.

**Dependent Variable**
Unit of rental rate per bigha per round (Y)

**Independent Variables**

*Sources of Hiring-in (SOH):* Distance from the home of owner of implement to the farm land to be ploughed has been captured in terms of sources of hiring-in. we have divided sources of hiring-in as within village and outside village. Hence, SOH is a dummy where SOH is 1 if source is within village and SOH is 0 otherwise.

Long distance movement of ploughing tractor consumes more amount of fuel. So, we can expect that longer is the distance, higher is the rental rate.

*Relation with the Owner of Capital Goods (RWCG):* RWCG is a dummy where RWCG=1 if hiring-in is from friend/relative, otherwise RWCG=0. A close relation between lessee and lessor generally suppresses the rental rates. So, it can be expected that rental rate is higher in case of open market hiring-in than the hiring-in from relative/friend.

*Location Characteristics:* Location of the present study covers three districts. Extent of use of ploughing tractor due to various reasons and the rental markets arrangement may vary across locations and so the rental rate too. Therefore, two dummies, L₁ and L₂ have been used
taking North Lakhimpur as base category where, \( L_1 = 1 \) for Morigaon, 0 otherwise and \( L_2 = 1 \) for Kamrup, 0 otherwise.

Monopoly power of the lessor is assumed to be one determinant of rental rate of different agricultural capital goods. But it is not included in the model constructed for finding out the determinants of rental rate of ploughing tractor. This is due to the fact that although a large number of lessees were found hiring-in ploughing tractors from sources outside the village but information about the number of available sources outside the village was not collected. Again, since no one lessee is reported as member of any farmers group leasing-out ploughing tractor, this variable has also been excluded from the regression model.

Now taking unit of rental rate per bigha as the dependent variable, the formulation of the model is done as follows-

\[
Y = F (SOH, RWCG, L_1, L_2) \quad \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots 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Table-5.2 shows that RWCG is negatively significant at 1 percent. It means that while relationship between lessee and lessor is crucial factor in determining rental rate of ploughing tractor, a close relation is associated with the relatively lower rental rate. The variable SOH is found to be not significant indicating absence of impact of distance between lenders’ home and land to be ploughed on rental rate of ploughing tractor. Constant is positively significant at 1 percent. Location dummies are not significant implying rental rates of ploughing tractor in Morigaon and Kamrup are not significantly differing from that of in North Lakhimpur.

Table-5.2: Results of Log-Linear Regression for Determinants of Rental Rate of Ploughing Tractor

<table>
<thead>
<tr>
<th>Variables</th>
<th>Estimates of coefficients/values</th>
<th>Standard errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOH</td>
<td>-0.03</td>
<td>0.10</td>
</tr>
<tr>
<td>RWCG</td>
<td>-0.37***</td>
<td>0.10</td>
</tr>
<tr>
<td>L1</td>
<td>0.06</td>
<td>0.13</td>
</tr>
<tr>
<td>L2</td>
<td>0.04</td>
<td>0.09</td>
</tr>
<tr>
<td>Constant</td>
<td>5.43***</td>
<td>0.10</td>
</tr>
<tr>
<td>R²</td>
<td>0.34</td>
<td></td>
</tr>
<tr>
<td>F(4, 28)</td>
<td>3.69**</td>
<td></td>
</tr>
</tbody>
</table>

Breusch-Pagan test
chi²(1) = 1.38
P = 0.2409
Result: No heteroscedasticity

In () degrees of freedom
** and *** represents significant at 5% and 1% respectively

5.4 Ploughing cum Leveller Tractor
Use of ploughing cum leveller tractor by sample households was reported only in Morigaon and in Kamrup. No sample household in North Lakhimpur was found using ploughing cum leveller tractor. Hence, data set used for the analysis of determinants of rental rate of ploughing cum leveller tractor consists of information collected from Morigaon and Kamrup only. Figure-5.3 (a) shows that similar to power tiller and ploughing tractor, on an average, hirers of ploughing cum leveller tractor from relative/friend pays lower rental rate (Rs.225.00 per bigha per round) than that of paid by the hirers from open market. Thus it gives the idea that the relation between the lessor and lessee reduces rental rate of ploughing cum leveller tractor. Again, in terms of sources of hiring-in, rental rate of ploughing cum leveller tractor is
lower in case of hiring-in from lessor within the village than that of hiring-in from lessor outside the village (Figure-5.3 (b)). However, for comparison of rental rates between hirers from lender(s) within villages and from lender(s) outside villages, data set of Kamrup district has only been taken. This is because in Morigaon, all have hired in ploughing cum leveller tractors from the lessors outside villages while no sample household in North Lakhimpur was found using it. Data reveals that rental rate of ploughing cum leveller tractor is lower for borrowers from within village source(s) than borrowers from the outside village source(s). Similar to the earlier cases to examine whether above derived impressions are statistically correct or not, now we will take the help of econometric tools.

**Dependent Variable**

Unit of rental rate per bigha per round (Y)

**Independent Variables**

*Sources of Hiring-in (SOH):* Distance from the home of owner of implement to the farm land to be ploughed has been captured in terms of sources of hiring-in. We have divided sources of hiring-in as within village and outside village. Hence, SOH is a dummy where SOH is 1 if source is within village and SOH is 0 otherwise.
Long distance movement of ploughing cum leveller tractor consumes more amount of fuel. So, we can expect that longer is the distance, higher is the rental rate.

Relation with the Owner of Capital Goods (RWCG): RWCG is a dummy where RWCG=1 if hiring-in is from friend/relative, otherwise RWCG=0. A close relation between lessee and lessor generally suppresses the rental rates. So, it can be expected that the rental rate is higher in case of open market hiring-in than the hiring-in from relative/friend.

Location Characteristics: Location of the present study covers three districts. Extent of use of ploughing cum leveller tractor due to various reasons and the rental markets arrangement may vary across locations and so the rental rate too. However, use of ploughing cum leveller tractor is found only in Morigaon and Kamrup. Therefore, dummy ‘L’ has been used taking Morigaon as the base category where, L=1 for Kamrup, 0 otherwise.

Monopoly power of the lessor is assumed to be one determinant of rental rate. But it has not been included in the model constructed for finding out the determinants of rental rate of ploughing cum leveller tractor time due to the fact that while a large number of lessees had hired in this capital goods from outside village sources, information about the number of such sources was not collected. Again, since no one lessee was reported as member of any farmer group involves in leasing-out of ploughing cum leveller tractor, this variable has been also excluded from the regression model.

Now taking unit of rental rate per bigha as the dependent variable, the formulation of the model is done as follows-

\[ Y = F (SOH, RWCG, L) \]  

(5.07)

Functional Specification of the Model

In the model dependent variable can take only positive values. Hence, exponential specification of the regression model will be suitable. Accordingly, an exponential specification of the formulation (5.07) has been made as follows-
\[ Y_i = \exp (\beta_0 + \beta_1 \text{SOH}_i + \beta_2 \text{RWCG}_i + \beta_3 \text{L}_i + U_i) \] \hspace{1cm} (5.08)

Since formulation-5.08 is non-linear, before estimating, formulation is made linear by taking log on both sides. Thus

\[ \ln Y_i = \beta_0 + \beta_1 \text{SOH}_i + \beta_2 \text{RWCG}_i + \beta_3 \text{L}_i + U_i \] \hspace{1cm} (5.09)

Where, \(U_i\) is the disturbance term which is assumed to be distributed normally.

As data set come from cross section sample, homoscedasticity assumption of the disturbance term may be violated. Hence, before estimating the parameters, presence of heteroscedasticity has been examined applying Breusch- Pagan test using STATA 11. The test confirmed the presence of heteroscedasticity in the data set. So, ordinary least square estimates of the parameters have been obtained after correction of the problem of heteroscedasticity by estimating White’s heteroscedasticity consistent robust standard errors.

Result shows that RWCG is negatively significant at 5 percent, i.e. a close relation of lessee with lessor helps in keeping rental rate of ploughing cum leveller tractor low. SOH is not significant, i.e. distance between lender’s home and land to be ploughed is not a matter in deciding rental rate of ploughing cum leveller tractor like as in case of other ploughing machineries. L is positively significant at 1 percent which indicates that rental rate of ploughing cum leveller tractor is significantly higher in Kamrup compared to Morigaon. Constant term is significant at 1 percent.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Estimates of coefficients/values</th>
<th>Robust standard errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOH</td>
<td>-0.01</td>
<td>0.02</td>
</tr>
<tr>
<td>RWCG</td>
<td>-0.27**</td>
<td>0.12</td>
</tr>
<tr>
<td>L</td>
<td>0.11***</td>
<td>0.04</td>
</tr>
<tr>
<td>Constant</td>
<td>5.62***</td>
<td>0.03</td>
</tr>
<tr>
<td>(F(3, 56))</td>
<td>5.27***</td>
<td></td>
</tr>
<tr>
<td>(R^2)</td>
<td>0.33</td>
<td></td>
</tr>
</tbody>
</table>

In (I) degrees of freedom

** and *** represents significant at 5% and 1% respectively
5.5 Conclusion
It may be recalled that this chapter is aimed at identifying the determinants of rental rates of power tiller, ploughing tractor and ploughing cum leveller tractor using econometric tools. Results reveal that relationship between lessee and lessor is a crucial determinant of rental rates of all types of ploughing machineries. It means a close relationship between lessee and lessor helps in keeping rental rate low. Thus, social contact is found important in determining rental rate of agricultural capital goods. Again, long distance between lands to be ploughed from lessors’ home is not found to be as a significant factor determining the rental rates of ploughing machineries. Further, two other factors, membership of group involving in hiring-out of concerned machinery and market power (monopoly power) of suppliers are studied only in case of power tiller rental. Membership of group acting as lender of concerned machinery is found to be as an important determinant of rental rate of power tiller time. In other words, membership of farmer group supplies machinery time make the hiring-in of machinery time cheaper for members of the concerned group. Market power of the suppliers is found to be insignificant, i.e. market power has no role in determination of rental rates.

In spite of the fact that number of suppliers is usually far smaller than the number of demanders in rental markets studied in the field survey, the insignificant impact of smaller number of suppliers in determination of the rental rates can be understood in terms of at least two factors- First, the probable market power of the suppliers is blunted by the availability of substitutes such as bullocks and plough units. Secondly, there is also a threat of suppliers coming in from nearby areas in the event of relatively higher rental rates. In other words contestability in the markets by owners of substitute agricultural capital goods and suppliers of same capital goods in nearby areas has kept market power of suppliers insignificant.