Chapter III

DESIGN OF STUDY

The present study related to the market structure of the four major foodgrains of the Punjab, viz., wheat, gram, maize and paddy.

Multi stage stratified random sampling technique was used to select the sample. The markets and the villages formed the primary and traders and farmers the ultimate units of study. The selection of the primary and ultimate units of study involved the following stages:

Selection of Markets

There were in all 83 regulated markets of foodgrains in the different parts of the Punjab in 1969-70, when this study was conducted. Because of the differences in cropping pattern of the different parts of the state, market arrivals were not limited to any one crop. However, some markets were predominantly wheat markets, whereas other were known for other foodgrains, viz., gram, maize and paddy. For the purposes of selection of sample markets, these 83 markets were considered commodity-wise.

The yearly data on market arrivals of wheat, gram, maize and paddy were obtained from 83 regulated markets for 1968-69 and 1969-70 for stratifying them into small, medium and large markets for each of the selected foodgrains. These data were transformed into frequency distributions for different foodgrains. Then the markets were classified into small, medium and large categories by making use of cum. $3/f(x)$ criterion\(^1\), where $f$ and $x$ stands for frequency and market arrivals respectively. This

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method was considered superior to other methods because it stratified the population into more homogeneous groups, which rendered the within strata components minimum (the between component is, therefore, maximum), thereby giving the least variance. The markets for wheat, gram, maize and paddy were categorized into small, medium and large and are presented in Table 3.1.

**Table 3.1**
The Boundary Lines (Arrivals) for Stratification of the Punjab Markets into Small, Medium and Large Markets (1968-70)

<table>
<thead>
<tr>
<th>Foodgrain</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>Less than 158665</td>
<td>158665 to 313245</td>
<td>313245 and above</td>
</tr>
<tr>
<td>Gram</td>
<td>Less than 6918</td>
<td>6918 to 19599</td>
<td>19599 and above</td>
</tr>
<tr>
<td>Maize</td>
<td>Less than 29611</td>
<td>29611 to 79256</td>
<td>79256 and above</td>
</tr>
<tr>
<td>Paddy</td>
<td>Less than 46682</td>
<td>46682 to 131139</td>
<td>131139 and above</td>
</tr>
</tbody>
</table>

On the basis of these specified boundary lines, the small, medium and large markets of the Punjab for the selected foodgrains are as given in Table 3.2.

**Table 3.2**
Distribution of Markets of Punjab by Size Groups for Wheat, Gram, Maize and Paddy (1968-70)

<table>
<thead>
<tr>
<th>Foodgrain</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>37</td>
<td>38</td>
<td>13</td>
<td>88</td>
</tr>
<tr>
<td>Gram</td>
<td>62</td>
<td>15</td>
<td>11</td>
<td>88</td>
</tr>
<tr>
<td>Maize</td>
<td>57</td>
<td>21</td>
<td>10</td>
<td>88</td>
</tr>
<tr>
<td>Paddy</td>
<td>57</td>
<td>18</td>
<td>13</td>
<td>88</td>
</tr>
</tbody>
</table>
A sample of 5 per cent markets with a minimum of two from each of the three size groups was selected randomly for wheat, gram, maize and paddy. The selected markets are shown in Table 3.3.

Table 3.3
Markets Selected for Wheat, Gram, Maize and Paddy for Detailed Investigation in the Punjab

<table>
<thead>
<tr>
<th>Market category</th>
<th>Wheat</th>
<th>Gram</th>
<th>Maize</th>
<th>Paddy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>Zira, Bhurcho Mandi</td>
<td>Moga, Patti</td>
<td>Zira, Abohar</td>
<td>Patti, Hoshiarpur</td>
</tr>
<tr>
<td>Medium</td>
<td>Abohar, Tarn Taran</td>
<td>Bhurcho Mandi</td>
<td>Tarn Taran, Mullapur</td>
<td>Zira, Kapurthala</td>
</tr>
<tr>
<td>Large</td>
<td>Moga, Khanna</td>
<td>Abohar, Moga</td>
<td>Hoshiarpur, Jagraon</td>
<td>Amritsar, Moga</td>
</tr>
</tbody>
</table>

The diversified cropping system followed in this region resulted into overlapping of the selected markets for different foodgrains. That is the reason that a particular market appears for more than one crop in Table 3.3.

Selection of the Traders

A list of the commission agents of different categories from 12 selected markets for 1969-70 was prepared. From each category of commission agents, a sample of ten per cent, with a minimum of five from each category, was taken randomly. However, in those markets, where the number of the commission agents was less than five, all were included in the sample. This gave a sample size of 157 marketing firms comprising 65 katcha arhtiyas, 55 katcha-paca and 37 paca arhtiyas.
Selection of the Markets to Study the Inter-Market Price Relationships

To study the problem of market integration or the degree of price relationships amongst the different markets of the Punjab with those of the other terminal markets in India, the markets presented in Table 3.4 were selected purposively to represent the following categories of markets:

1. major producing and export markets of the Punjab,
2. major consuming markets of the Punjab, and
3. distributing and terminal markets of foodgrains in India.

These were the markets for which time series data of equivalent varieties were available from the published sources. Besides, these markets belonged to the States which imported largest quantities of foodgrains from the Punjab.

Table 3.4

Selected Markets for Wheat, Gram, Maize and Rice Inter-Market Price Relationships

<table>
<thead>
<tr>
<th>Market category</th>
<th>Foodgrain</th>
<th>Wheat</th>
<th>Gram</th>
<th>Maize</th>
<th>Rice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Export and producing markets of the Punjab</td>
<td></td>
<td>Soga,</td>
<td>Abohar,</td>
<td>Jagraon,</td>
<td>Amritsar,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Khanna,</td>
<td>Mansa,</td>
<td>Hashiarpur,</td>
<td>Batala,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Abohar</td>
<td>Barnala</td>
<td>Khanna</td>
<td>Kapurthala</td>
</tr>
<tr>
<td>Consuming markets of the Punjab</td>
<td></td>
<td>Amritsar,</td>
<td>Amritsar,</td>
<td>Amritsar,</td>
<td>Amritsar,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ludhiana,</td>
<td>Ludhiana,</td>
<td>Ludhiana,</td>
<td>Ludhiana,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Patiala</td>
<td>Patiala</td>
<td>Patiala</td>
<td>Patiala</td>
</tr>
<tr>
<td>Terminal markets in India</td>
<td></td>
<td>Bombay</td>
<td>Delhi,</td>
<td>Bagraich,</td>
<td>Delhi,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delhi,</td>
<td>Patna,</td>
<td>Delhi,</td>
<td>Calcutta,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hapur</td>
<td>Hapur</td>
<td>Khagaria</td>
<td>Nagpur</td>
</tr>
</tbody>
</table>

Selection of the Villages

The informations obtained from the various market committees revealed that the number of the villages attached to
each market was not uniform. Therefore, it was thought appropriate to select one percent of the villages randomly with a minimum of one village from each market, thus making a sample of 21 villages in all.

Selection of the Farmers

A list of the farmers in the different sample villages was prepared in consultation with the local revenue staff and the local leaders. Five per cent of the farmers from each of the sample villages, forming a sample of 145, were selected randomly for detailed investigation. Using the same criteria, as used for stratification of markets, all the sample farmers were classified into small, medium and large groups. The strata boundary lines and the number of farmers in each stratum are shown in Table 3.5.

<table>
<thead>
<tr>
<th>Size category</th>
<th>Number</th>
<th>Boundary lines (hectares)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>62</td>
<td>Less than 5.71</td>
</tr>
<tr>
<td>Medium</td>
<td>54</td>
<td>5.71 to 10.43</td>
</tr>
<tr>
<td>Large</td>
<td>29</td>
<td>10.43 and above</td>
</tr>
</tbody>
</table>

Collection of Data

Much of the work of this investigation related to the assembling and developing data which has a bearing on changes in foodgrain market structure, conduct and performance. The sources of the data used for meeting the objectives of this study fall
into two main categories: (1) published materials, and (2) direct interviews with the help of schedules served to a selected sample of producer-farmers and the different categories of marketing firms. (Appendices 3.1 and 3.2)

The price data pertaining to the selected terminal markets for wheat, gram, maize and paddy were obtained from the annual issues of the Bulletins on Food Statistics published by the Directorate of Economics and Statistics, Ministry of Food and Agriculture, Government of India, Delhi. In each, the price data mostly pertained to the more or less uniform quality grain. The data on procurement of foodgrains of wheat and rice by the government (Central and State government), and information on zonal curbs on the movement of foodgrains, stocks of foodgrains with the private trade etc., were gathered from the Annual Reports of the Food and Civil Supply Department of Punjab. The price and arrival data of the sample markets of Punjab were assembled from the registers maintained by the offices of the market committees.

The data available from published sources were considered insufficient for meeting the objectives of study. To examine the impact of the government policy measures on market structure and behaviour of the producer-farmers and the marketing firms, it was considered necessary to develop primary data. For this purpose a survey of those markets of the Punjab was made, for which arrival data were not available for 1968-69 and 1969-70 from the registers maintained in the Marketing Section of the Economics and Sociology Department of Punjab Agricultural University, Ludhiana. This was done because such data for the entire markets of the Punjab
(38 markets) were required for planning the sampling design of this study.

Interview method was used for collection of primary data from the sample producer-farmers and the marketing firms better known as commission agents.

The data were obtained from the farmers in respect of size of operational holdings, land resource allocation and production levels of selected foodgrains, quantities of foodgrains retained to meet fixed needs, disposal of marketed surplus over space and time, factors affecting the selection of the markets for disposal of foodgrains, credit borrowing activities, assessment regarding the State Trading Policy of the government, etc. In most cases, the data pertained to the period 1967-68 through 1970-71.

The market structure, conduct and performance data related to the various categories of commission agents were also collected through direct interviews with the help of a specially designed schedule. This included the number and size distribution of the marketing firms, interfirm and intrafirm relationships, horizontal and vertical integrations, patronization of firms and farmers, storage operations and storage costs, condition of entry and exit, transportation costs, etc. The data mostly pertained to the period 1967-68 to 1970-71.

The impact of take-over of wholesale trade in wheat was studied by selecting three of the total six wheat markets included

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2. This part of the data was collected in 1975 to meet the objection of one of the two examiners who suggested that the discussion of the factors determining post-harvest sales by the farmers should precede with the isolation of the factors determining quantity of foodgrains retained for family consumption and other contractual obligations. The data on retention pertain to 1972-73 through 1974-75.
in the master sample. Of these three markets, one each belonged to the small, medium and large market categories. The selection of the market from each size category was made randomly. Besides, 45 farmers were also contacted to examine the impact of wheat take-over on their marketing behaviour during 1972-73.

**Technique of Analysis**

The technique of analysis used in this study was largely conditioned by the limitations of the data. Because of the too many and frequent changes in the government policy instruments and the severe shortage of the time series data generated in the process, the more sophisticated statistical techniques could not be used. The results were interpreted mostly through the tabular and logical deduction. Wherever the data permitted, statistical techniques and models were developed to examine the major technical changes in the market structure.

**Nature of Competition in Foodgrain Markets**

The degree of concentration on the buyer's side was studied through the technique of Lorenz curve for different foodgrains separately. Further, to arrive at a single index of concentration, Gini coefficients were computed for the period 1967-68 through 1970-71. Ten groups were formed for estimating the values of Gini Ratios.

\[
\text{Gini Ratio} = 1 - 2L = 2A
\]

where

\[
L = 1 - \sum_{j=1}^{k} (a_j + a_{j-1})
\]

\[
a_j = \sum_{i=1}^{j} p_i y_i / \sum_{k=1}^{k} p_k y_k
\]

\[
p_j = \sum_{i=1}^{j} p_i
\]
(where $P_i$ is the estimated proportion of population in the $i$th size class)

$2A = \text{twice the area of concentration.}$

The log normality of the data was tested by fitting probit function of the following type for each category of the market firms for each year:

$$Y = a + b \log X$$

where, $Y = \text{probit, and } x = \text{volume of business of each selected foodgrain handled by the different categories of firms.}$ The probit functions along with the values of $R^2$ are shown in Appendix 3.3.

In order to test the hypothesis that market shares of various competitors, that is, commission agents, was proportional to their effort share, that is, their shares of total credit advanced to the farmers, it was assumed that competitor's marketing efforts did not differ in qualitative content. According to the fundamental theorem of market share determination,

$$S_i = m_i = \frac{M_i}{M} \quad (S_i \text{ is proportional to } m_i)$$

where,

$S_i = \text{firm's market share,}$

$m_i = \text{firm's effort share, that is, the share of total credit advanced to the farmers by all the selected commission agents,}$

$M_i = \text{ith firm's marketing effort, that is, credit advanced by ith firm in rupees, and}$

$M = \text{marketing effort of all the selected firms in rupees.}$

3. Probit functions were used to convert sigmoid curve into straight line.
simple correlation coefficient \( r \) and regression
analysis was used to establish the extent of relationship between
\( m_4 \) and \( s_4 \). The effort share \( (m_4) \) was considered approximate to
the market share \( (s_4) \) when the correlation coefficient between
\( m_4 \) and \( s_4 \) was significant.

**Spatial Price Relationships**

The Government Zonal Policy measures as they operated
in the Punjab state in respect of wheat, gram, maize and paddy
were classified into free trade, multi-state zone, and single
State zone periods. The wholesale monthly price data of similar
varieties of the selected foodgrains were obtained from the
published sources for each policy period. Though there was a gap
of time when a particular policy was repeated, yet it became
necessary and logical to pool the price data for the purposes of
working out market integration and price seasonality for each
selected foodgrain during different zonal policy periods. The
sources and the nature of the price data are discussed in detail
in Chapter VII.

Spatial price relationships between the selected markets
were studied\(^4\) by examining the absolute differences between
market prices, in comparison with transport costs. The actual

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4. Cummings Jr. (1968); Lele (1968); Parruk (1970); Thakur (1973);
Blyn (1973); Jasdanwala (1966); Mahendru (1937); studied
spatial price relationships (market integration) with the help
of correlation analysis. They worked out the correlation
coefficients between the prices prevailing in the selected
markets. Degree of correlation between prices in various
markets was taken as an index of the extent of market
integrations. However, on the advice of the examiner, spatial
price relationships are studied by examining the absolute
differences between market prices in comparison with transport
costs.
handling costs in transferring one quintal of selected foodgrains from the markets of Punjab to those of the selected terminal markets were worked out by securing relevant data from the traders, railway records and the truck unions. The transfer costs included the expenses which the trader had to pay as a buyer in the Punjab markets and the expenses he incurred as a seller in the terminal markets, plus the actual transport costs.

Similarly, the temporal price relationships were examined by comparing the costs of storage with the price rise in the lean months of the year (when the stocks are released) over the post-harvest period (when the stocks are build). Conceptually in a competitive market the spatial and temporal price differentials can exist but these cannot exceed the costs of transfer and costs of storage respectively.

**Algebraic Models**

The following algebraic models were used to examine the factors affecting post-harvest sale of foodgrains by the farmers, the storage operations of the private trade and the market share function of the different categories of the marketing firms.

1. Linear Function:

   \[ Y = b_0 + \sum_{i=1}^{n} b_i X_i \]

2. Cobb-Douglas:

   \[ Y = b_0 \prod_{i=1}^{n} X_i^{b_i} \]

   where \( \prod \) denotes product.

**Post-Harvest sale of Selected Foodgrains by the Sample Farmers and the Factors Affecting it.**

The post-harvest sales of different foodgrains and the
factors affecting it were analysed separately for small, medium and large farmers for the period 1967-68 to 1970-71. In view of the considerable changes in the production in the wake of technological break through in the Punjab (Appendix 4.2), the aggregation of four years was considered inappropriate. Separate functions for each year were fitted.

In this functional analysis, the variables used were:

\[ Y = \text{the post-harvest sale of a foodgrain in quintals,} \]
\[ X_1 = \text{total production of foodgrain in quintals,} \]
\[ X_2 = \text{size of operational holding in acres,} \]
\[ X_3 = \text{total marketed surplus during the year of the foodgrain in quintals, and} \]
\[ X_4 = \text{total credit borrowed in rupees during the preceding year (t-1) from the different sources by the farmer.} \]

B. Post-Harvest Marketed Supply Function.

The relationship between the percentage of market arrivals received in the post-harvest period to the total annual arrivals of the selected foodgrain with various factors affecting it was also studied by using time series data. The variables included in the model were:

\[ Y = \text{post-harvest arrivals of the selected foodgrain in quintals,} \]
\[ X_1 = \text{production of foodgrain (in view) in the Punjab in thousand metric tons,} \]
\[ X_2 = \text{post-harvest prices of foodgrain per quintal in rupees,} \]
\[ X_3 = \text{price differential between post-harvest and lean period, of selected foodgrain in the preceding year, and} \]
C. Storage Function of Private Trade

The storage pattern of private trade with respect to different selected foodgrains for single state, multi-State zone and free trade periods was examined in relation to the following explanatory variables.

\[ Y = \frac{\text{quantity of foodgrain stored in a year (weighted average)}}{\text{in quintals.}} \]

\[ X_1 = \text{maximum credit limit of the trading firm in rupees,} \]
\[ X_2 = \text{storage capacity owned by the firm in quintals,} \]
\[ X_3 = \text{quantity of respective foodgrains purchased on own account in quintals, and} \]
\[ X_4 = \text{quantity of foodgrain purchased on other's account in quintals.} \]

The Problem of Multicollinearity

When two or more independent variables were so highly inter-correlated, it made it difficult, if not impossible, to ascertain the effect of each on the dependent variable. To safeguard against this problem and to get the unbiased estimates of the parameters with respect to various explanatory variables, zero order correlation matrix for each situation was worked out (Appendices 3.3 to 3.11) and the following criteria were used to determine the extent of multicollinearity.

According to Heady and Dillon (1961) and Klein (1969) multicollinearity is a problem, only when the simple correlation
coefficient between any two independent variables is greater than 0.8 and/or value of simple correlation coefficient is greater than the magnitude of coefficient of multiple determination. In this study, both the tests were satisfied before fitting the algebraic functions.

The Choice of the Fitted Algebraic Functions

The final choice of the fitted algebraic functions for detailed economic analysis rested on the following three criteria:

1. highest value of the coefficient of multiple determination,

2. statistical significance of the regression coefficients, and

3. economic considerations, such as, the logic of economic theory and the meaningfulness of the signs of regression coefficients.