Output and prices of food-grains play a pivotal role in developing countries. Agriculture is important not only because it sustains 2/3rd of total humanity but it is important because it happens to be the life line of national economics and the foundations of national wealth and welfare of the most of the countries of the world. Notwithstanding, the heat in Indian economy generated by occasional shortages of agricultural commodities in particular years, the annual compound rate of growth of output of cereals is 3 percent which is highly impressive indeed. Besides, food-grains account for as high as 80 percent of total cultivable area and a very high proportion not only of total agricultural output but also of gross domestic output.

Changes in output are accompanied by changes in prices of agricultural goods which change the sectoral turns of trade. Since income of farmers changes in the same proportion in which prices of agricultural goods change, change in output shifts the pattern of income distribution directly as well as via prices. Thus, income distribution and agricultural prices are not independent of each other.

Agrarian structure as reflected in differences of size of holdings affects marketable surplus, to a great
extent. It is generally seen that marginal and small farmers engage themselves in subsistence farming; while cultivation on commercial scale is taken up by medium and large farmers alone. A great proportion of marketable surplus of small farmers is accounted by distress sales. But a large proportion of marketable surplus of large and medium farmers is in the nature of commercial sales. Thus, the former group of farmers treat consumption of food-grains rather than marketable surplus as a residual. Consequently, supply curves of food-grains, in the short-run, are backward bending; while consumption curves of food-grains are upward sloping (25, 27, 37). But the supply curves of food-grains, in case of second group of farmers, may have the normal upward slope and consumption curves may slope downwards. Perverse behaviour with respect to consumption and sales of food-grains affect both demand and supply simultaneously. In this chapter, we attempt to estimate farmers' propensity to sell food-grains in different income/output situations. As the following study is based on a cross section of house-holds belonging to the same village in a given year, all of them have faced the same price situation. We therefore, have not been able to derive estimates of price elasticity of marketable surplus.
DATA SOURCE:

Data relating to variables of marketable surplus have been taken from a census survey of Sunhor village. A detailed schedule was convassed among the respondents and data have been gathered by personal interview. Out of total 310 households in the village, 150 are engaged in cultivation. Rest of the households belong to other occupation groups. Though 25 non-respondents were recorded yet none of them is an agriculturist. Data collected by us relate to a period of three years 1976-77, 1977-78, 1978-79. The figures used are averages of the three years, so that they are not likely to be affected by cyclical changes in weather conditions being especially favourable or unfavourable in a particular year.

Methods and Empirical Results:

What proportion of food-grains is released to the market depends upon farmers' needs for human consumption, seeds, cattle-feed and their capacity to hold stocks, and future prospects of prices. In this study, attempt for estimation of relationship between marketable surplus and output/income on the one hand and marketable surplus and size of holding on the other hand, is made. Due to non-availability of data about stocks, we have used the term marketable surplus in our study. Wheat, Paddy and all
food-grains have been selected for this study. First two commodities are constituents of the last commodity. Marketable surplus of all food-grains is obtained as a weighted average of marketable surplus of first two commodities. We have the information of production and sale of commodities in physical terms. Area held by each of the 150 households was also given. We divided all the households into four different size groups.

Size and Marketable Surplus:

Agrarian structure is one of the factors that affect marketable surplus. Agrarian structure is determined mainly by land relations, which in their turn, get reflected in size distribution of holdings. So, it is assumed that size of holding is an important determinant of marketable surplus. Few attempts have been made to estimate relationship between size of holding and marketable surplus. However, their findings are strikingly different. Here we have tried to test the hypothesis that short-run supply curve of food-grains are negatively sloped with latest data. Table 7 reveals that income/output and marketable surplus of wheat, paddy and all food-grains per house-hold increase with size. Thus, the table lends support to the hypothesis of a positive relationship between size of holding on the one hand, and
income, output and marketable surplus on the other hand. Besides, marketable surplus, both of wheat and paddy, as a proportion of output also increases steadily with size while in case of all food-grains, it increases from first to second group, but declines negligibly from second to third group and increases thereafter. An implication of an increase in marketable surplus as a percentage of output with an increase in size is that self consumption of wheat, paddy and all food-grains decreases with an increase in size of holding. Another important point comes out that proportions of output sold by various groups are quite high and these percentages do not seem to differ much from one group to another.

For statistical significance, we have tested differences of these proportions, and we find that it is only the first group which differs significantly from other groups jointly as well as separately both in case of wheat and paddy. But in case of all food-grains, differences between these proportions are statistically significant for all four groups jointly as well as separately. Both wheat and paddy occur as a cash crop for all groups of farmers except the first group. This is due to the fact that farmers belonging to first group consume themselves much higher proportion of their produce than those belonging to higher size groups.
Results of this study stand in contra-distinction to those of Dharm Narain, according to whom, marketed surplus as a proportion of output declines as size of holding increases up to the size group 10 to 15 hectares, it rises thereafter with size of holdings. However, these results are similar to those of Utsa Patnaik (31) RBI (20) Sharma (41) and George and Singh (43).

Wheat

The relative share of farmers of different groups in total marketable surplus are shown in table (9). Percentage share in total marketable surplus of wheat increases consistently with an increase in size of holding up to third group; and it declines marginally from third to fourth groups. Within the first group itself, those farmers size of whose holdings is less than 2 hectares, account for as negligible as 0.44 percent of total sales, whereas their share in total output is 0.51 percent. Farmers size of whose holdings is between 2 to 3 hectares, account for 2.36 percent of total sales, whereas their share in total output is 2.87 percent; and the farmers size of whose holdings is between 3 to 5 hectares, account for 8.19 percent of total sales and 9.08 percent of total output respectively. If we consider these farmers, as a whole, they account for only 10.94 percent of total sales while their share in total output is 12.44 percent. Hence, the contribution of those farmers separately as well as jointly to sales is commensurate with their contribution to total output.
Contribution to total sales and output of wheat of I group of farmers, taken as a whole, as well as in sub-groups, relatively to large farmers is extremely low. Has the proportionate share of small farmers in output been significantly higher or lower than their proportionate share in marketable surplus, then their behaviour would have been different from that of farmers belonging to large size groups. Thus, in our study, size does not emerge as an important determinant of marketable surplus, in case of these farmers. As for other three groups, their relative contribution to total sales does not seem to differ significantly even though each of these groups' contribution is nearly 3 times the contribution made by the first group. Relative share in output of the other three groups comes out to be 29.93, 19.68 and 27.91 percent, respectively, which in its turn, is 2½ times the share of small farmers. It means that the relative shares of different groups of farmers in total sales are commensurate with their relative shares in output.

Paddy:
Results for paddy are almost similar to those of wheat. First three sub-groups of farmers account for as little as 0.55 percent, 4.05 and 6.03 percent of total sales of paddy respectively, while their corresponding shares in production are 0.62, 4.22 and 6.49 percent.
All three sub-groups taken together, contribute as low as 10.35 percent of total sales and 11.32 percent of total output. We find, in our study, that contribution of small farmers to sales and output of wheat and paddy relative to that of large farmers is extremely low. Thus, these results show that output and market arrivals of wheat and paddy both are not likely to be affected greatly by changes in output and marketable surplus of small farmers because as large as 71 and 85 percent of their total output of wheat and paddy respectively. These results also confirm positive association between marketable surplus and size.

Regression equations of marketable surplus of wheat and paddy as a proportion of total output on size of holding from 150 observations estimated by ordinary least square method are given below:

\[
\log \frac{M_w}{O_w} = 2.065 + .188 \log S \quad (r^2 = .00115)
\]

\[
(4.128)
\]

\[
\log \frac{M_p}{O_p} = -.607 + .3430 \times \log S \quad (r^2 = .0727)
\]

\[
(3.47)
\]

Both regression and correlation coefficients are positive in both the equations. However, variation in size explains as little as .12 and .27 percent of total variation in marketable surplus as a proportion of output and size elasticity in case of both wheat and paddy is as low as 0.19 and 0.24 which means that, though marketed surplus as a
proportion of output increases with size, yet the increase is not different from zero statistically. The statistical significance of these coefficients, however, seems to be a consequence of large size of sample. It seems that insufficient variation in size within individual groups affect the statistical significance of parameters estimated from group data. If we remove this constraint both correlation and regression coefficients emerge statistically significant. This seems to be an odd result in view of our finding that size is a non-significant determinant of marketable surplus.

Estimated equations for each group separately are given in table (8). Important features of these results are as follows:

1. Regression and correlation coefficients are not significant statistically for any group either for wheat or for paddy.

2. Marketable surplus of wheat as a proportion of output is positively related with size in case of first and third groups; while there is an inverse relationship for second and fourth groups respectively.

3. Marketable surplus of paddy as a proportion of output shows positive relationship for first and fourth groups, while an inverse relationship between size and marketable surplus is revealed for other two groups.
Thus, the relationship between size of holding and marketable surplus as a proportion of output is neither uniformly positive nor negative for four groups examined separately. Statistical non-significance of estimated elasticities may probably be due to insufficient variation of size of holdings within a given group. However, when individual observations for all groups are taken together, constraint of insufficient variation in size is removed. Though estimated elasticity turns out to be positive, yet it is not significant statistically in case of wheat, as large as 148 degrees of freedom notwithstanding.

Therefore, our results do not lend support either to positive or negative relationship between marketable surplus of wheat and size of holdings, and thus, size of holding does not seem to be a decisive determinant of marketable surplus either separately for four groups or jointly.

Homogeneity of Means:

Output and income are generally highly and positively correlated with size of holdings. As there is a very high degree of variation in size (1 to 60 hectares) both output and income are also likely to show an equally sharp degree of variation. These variations might cause group means
to be significantly different. Hence, we test the data for homogeneity of means of income and output as well as the homogeneity of mean of dependent variable i.e. market sales for different size groups of holding. While keeping this in view, sampled households have been divided into four different groups according to area owned. First group consists of small and marginal farmers, size of their holding ranges from 1 to 5 hectares, second and third group is that of medium farmers whose holding ranges from 5 to 10 and 10 to 20 hectares respectively. Last group consists of large and rich farmers whose holdings range between 20 to 60 hectares. In order to test the homogeneity of means, weighted means of per capita output and sales of each group separately as well as jointly are calculated. While comparing group means with composite mean, mean differences have been estimated by the following formula:

$$Z_i = \frac{(\bar{X}_j - \mu) \times \sqrt{n_i}}{\sigma}$$

where $X_j$ stands for means of $j$th group, $\mu$ is the composite mean of all groups taken together, $\sigma$ is standard deviation of the composite series and $n_i$ is the size of $i$th group. Values of $Z$ statistics are as follows:
### Y Statistics

<table>
<thead>
<tr>
<th></th>
<th>Heat Output</th>
<th>Sale</th>
<th>Paddy Output</th>
<th>Sale</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>2.08966*</td>
<td>2.0925*</td>
<td>2.2007*</td>
<td>2.353</td>
<td>3.7308*</td>
</tr>
<tr>
<td>Group 2</td>
<td>0.62506</td>
<td>0.05458</td>
<td>0.8474</td>
<td>0.6435</td>
<td>0.5774</td>
</tr>
<tr>
<td>Group 3</td>
<td>0.04550</td>
<td>0.1763</td>
<td>0.09747</td>
<td>0.0971</td>
<td>0.19026</td>
</tr>
<tr>
<td>Group 4</td>
<td>2.7502*</td>
<td>2.6431*</td>
<td>3.6183*</td>
<td>3.7077*</td>
<td>4.3706*</td>
</tr>
</tbody>
</table>

Above results show that means of first and last groups differ significantly from composite mean for all five series, while means of second and third groups do not differ from each other significantly. As expected, difference between means of these two groups themselves do not differ significantly from zero. Intergroup differences are tested by the following formula:

\[ Z = \frac{\bar{x}_i - \bar{x}_j}{s} \]

where \( \bar{x}_i \) is the mean of ith group and \( \bar{x}_j \) is the mean of jth group and \( s \) is the standard deviation of two groups combined together.

Thus, it is the richest and the poorest who differ not only among themselves but also differ from all farmers taken together. But middle level farmers neither differ among themselves nor from all farmers taken together.
II. Output as Determinant of Marketable Surplus:

Output is considered as an important determinant of marketable surplus. Total elasticity of marketable surplus with respect to output has been estimated for all the four groups taken together as well as for each group separately by the following equation:

\[ \log M_j = \log \alpha_i + \beta_j \log X_j \]

\( j = \) wheat or paddy
\( i = \) income or output

\( M = \) Marketable surplus.

An important property of this curve is that it has the same constant value of elasticity at every point of estimated line. Equations estimated by OLS method from data for each group taken separately for both wheat and paddy are reported in table (9). Regression equation estimated from composite data of wheat is given below:

\[ \log M_{it} = -0.1853 + 1.0519 \log O_w \quad (r^2 = 0.9322) \]

(45.1102)

Coefficients of correlation and regression are positive and highly significant. Changes in output explain as high as 93.22 percent of total variation in sales of wheat. Output elasticity is not only positive but it is slightly greater than unity also, which means that
Marketable surplus responds more than proportionately to changes in output.

Estimated equations for all the four groups show that output elasticity of wheat and coefficient of correlation are positive and highly significant statistically. Elasticity for the first two groups is slightly more than unity and it is slightly less than one for the last two groups, which implies that response of marketable surplus to changes in output is more in case of all farmers taken together and in case of first two size groups than what is in case of last two groups. Thus, the behaviour of small farmers is similar both quantitatively and qualitatively to that of all farmers taken together. Output elasticities of marketable surplus of wheat reveal that market sales of small farmers are more responsive to changes in output than the sales by large farmers. These results reveal that changes in output account for as much as 93, 31, 90 and 98 percent of total variation in marketable surplus of wheat.

Regression equation in case of paddy for all groups of farmers taken together is given below:

\[
\log M_p = -0.02086 + 0.9899 \log O_p \quad r^2 = 0.9498* \\
t (52.92)
\]
Both regression and correlation coefficients are positive and highly significant statistically. Changes in output explain as high as 95 percent of total variation in sales. Elasticity of output is less than unity which implies that the sales respond less than proportionately to changes in output of paddy. Results, when all the four groups are taken together, show that output elasticity of paddy and coefficient of correlation are positive and highly significant statistically. Changes in output of paddy account for as high as 92, 90, 98 and 100 percent of total variation in marketable surplus for all the groups. Output elasticity is slightly more than one in case of last two groups and less than one in case of first two groups of farmers. An interesting point to note is that output elasticity of wheat is more than one in case of first two groups while in case of paddy, it is more than one in case of last two groups. Thus, for larger farmers, paddy is a commercial crop to a large extent, than what it is to the small farmers, or all farmers taken together.

**Income as Determinant of Marketable Surplus**

Regression equation of marketable surplus on income of wheat estimated from all 150 observations is given below:

\[ \log M_w = 2.7968 + 0.5475 \times \log Y \quad (r^2 = 0.4922) \]

\[ t \quad (11.98) \]
Correlation and regression coefficients are positive and highly significant statistically. Changes in income explain only 4% percent of total variation in sales. Thus, output is more decisive a determinant of marketable surplus of wheat than income. Income elasticity is much less than unity (0.55) in case of 150 observations taken together. In case whole of the income is derived from agriculture, output and income would be perfect substitutes for each other. In case, income from sources other than agriculture is derived, there will be divergence between income and output. Greater the proportion of income derived from other sources, greater will be this divergence and smaller will be the effect of change in income upon marketable surplus. An implication of these results is therefore that farm households studied have got diverse sources of income and they seem to be deriving a substantial proportion of income from these other sources.

All income elasticities of wheat and coefficient of correlation are positive and statistically significant except for the fourth group. Variation in income accounts for only 60, 66 and 37 percent of total variation in marketable surplus of wheat of first three groups. But in case of fourth group, it accounts for only 7 percent of total variation. Another difference is that income
elasticity of wheat is much less than the output elasticity for all four groups. Only for the first group, it has a somewhat high value that is 0.92; while for other three groups, it is as low as .49, .57 and .14. It implies that marketable surplus is less responsive to changes in income than output. Income elasticity is not greater than output elasticity for any individual group as well as all the groups taken together.

Regression equation estimated from 150 observations for paddy is as follows:

\[ \log M_p = 2.6622 + 0.60319 \times \log Y \quad (r^2 = 0.5970) \]

Regression and correlation coefficients are positive and highly significant in case of paddy also. Above equation shows that changes in income explain 59.78 percent of total variation in marketable surplus. Income elasticity is less than unity which is 0.60 and it is greater than the income elasticity of wheat. For the individual four groups, results are similar. But the proportion of variation in it explained by changes in income are as low as 39, 46, 60 and 27 percent for four groups. Values of elasticity range from .35 for the fourth group to .60 for the third group.

Income elasticity, like output elasticity, for the last two groups in case of paddy, is greater than its
value for the first two groups. Another feature of these results in this study is that income elasticity of market surplus of paddy is much less than income elasticity of wheat for each of the four groups.

Thus, all above results and discussion, lend a very strong empirical support to the hypothesis of there being a positive relationship between income and marketable surplus and marketable surplus and output. But output happens to be a much more important determinant of marketable surplus than other factors such as income or size of holding. This may be due to the degree of diversification of sources of income. Greater the proportion of income derived from a particular crop/all crops, smaller will be the difference between output and income elasticities.

Another feature of these results is that sales behaviour of farmers in different income/output groups seems to be different. Hence, we have tested homogeneity of regression parameters with the help of Chow statistics. For testing homogeneity the assumption of group data are treated as the sub-sample of the data of all the farmers taken together. F ratios are tabulated below:

F ratios:

<table>
<thead>
<tr>
<th></th>
<th>Wheat M_w and O_w</th>
<th>M_w and Income</th>
<th>Paddy M_p and O_p</th>
<th>M_p and Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>F ratio</td>
<td>7.2052*</td>
<td>88.7242*</td>
<td>22.822*</td>
<td>3.3596*</td>
</tr>
</tbody>
</table>
These values of F ratios show that estimated regression parameters attached to income and output in case of both the commodities: wheat and paddy, are significantly different, which lends support to the view that farmers belonging to different income/output groups respond differently in quantitative terms to changes in income and output, so far as their sales behaviour is concerned. However, there does not occur any qualitative difference because all the elasticities have positive sign. Thus, we find that there is not much significant difference, qualitative or quantitative, in the behaviour of farmers belonging to different income/size group drawn from non-regressed statistical analysis is not supported by these results.

Significant differences of group variances may cause heteroscedasticity which makes OLS method of estimation inappropriate. So keeping in view the significant differences between parameters estimated from data for each group of farmers separately and the significant mean differences, we test our results for homogeneity of variances of residuals of the entire sample consisting of 150 observations.

The differences of variances have been examined by $X^2$ test given below:
\[ i = C^{-1} \left( n \log \frac{S_i}{n} - \sum_{i=1}^{n_i} \log \frac{S_i}{n_i} \right) \]

\[ C = 1 + \frac{\sum_{i=1}^{n_i} \frac{S_i}{n_i} - \frac{1}{n}}{2(n-1)} \]

\[ X^2,05 \text{ for } 3, d.f = 7.815 \] where \( S_i \) is the sum of squares of deviations from the mean of \( i \)th sample, \( \frac{S_i}{n_i} \) is the variance of \( i \)th sample; \( n_j = n_j-1 \) and \( K \) is the number of parameters estimated. Calculated results are tabulated below:

1. \( M = \frac{\text{Wheat}}{42.38^2} \quad \frac{\text{Paddy}}{93.99^2} \quad \frac{\text{All food-grains}}{170.329^2} \)
2. \( C = 1.015 \quad 1.015 \quad 1.015 \)

Above values show that variances are significantly different for wheat and paddy and all food-grains taken together. So null hypothesis of homogeneity of variances is rejected. In view of this, we have estimated the parameters for different groups separately. We can, therefore, not put much reliance in elasticities estimated from data of all sampled households taken together.

Important features of the study are as follows:

a) Size is not a decisive determinant of marketable surplus. If there is any influence of size on marketable surplus, it is not direct. It might be exercising its influence via income and/or output.
b) Consumption levels of small and marginal farmers are low, so they treat food-grains as a superior good even in post-green revolution period. Increase in output and income raises only their consumption rather than augmenting market sales. Therefore, an inducement or incentive in the form of higher prices is not likely to affect either the sales behaviour of these farmers, so long as their pent up demand is not satisfied completely.

c) Paddy, for medium and large farmers, is wholly a commercial crop while wheat is partially but largely a commercial crop. It is because wheat constitutes staple diet of the people of this region and rice is consumed only once in a while by most of the households of this region.

d) As the amount of paddy and wheat withheld by farmers of different groups for their own use is as large as can satisfy only their own requirements of self-consumption, it does not indicate the probability of large stocks being held for speculative purposes. So any policy of inducement or incentive can not substantially raise market arrivals.

e) Both output and income have been found to affect marketable surplus significantly for all groups of farmers.
taken separately as well as jointly. Hence, incentives and inducements to raise output or income, whatever be their form, are the means through which market arrivals can be raised largely. But even the medium and large farmers do not have the stocks in their possessions to operate with in order to affect prices prevailing in the market at any time, once the level of output/income is determined.

f) Another important implication of above results is that if one wants to enlarge the size of marketed surplus either for building buffer stocks or for meeting ever increasing urban demand for food-grains or to keep the price fluctuations within the limits during the periods of shortages, efforts and inducements should be directed towards medium and large farmers as small farmers contribute very inconsequential if not negligible proportion of total marketable surplus.