CHAPTER 4
GOVERNMENT OPERATIONS IN RICE AND WHEAT MARKETS:
ASPECTS OF PROCUREMENT, DISTRIBUTION, STOCKS AND IMPORTS

4.1 Introduction
Procurement, imports and change in stocks are three sources of supply through which the government maintains its public distribution system and attempts to achieve other objectives of food policy. The role of imports has been gradually on the decline while that of domestic procurement has been rising in the net availability of rice and wheat (see Appendices 4.1 and 4.2). Since these factors are closely inter-related, these are considered together.

Section 4.2 on procurement deals with temporal and regional behaviour of procurement, institutional arrangements and determinants of procurement. In Section 4.3 trends in public distribution are discussed and factors that determine offtake from PDS are identified. Government's stock operations are examined in Section 4.4. Stocks are determined residually in the model through an identity. Imports are treated as exogenous to the system, discussed briefly in Section 4.5. Summary and conclusions of the chapter appear in Section 4.6.

4.2 Procurement of Rice and Wheat
Procurement is a major policy instrument in the management of food economy. It aims at preventing post-harvest crash in prices and also providing government with a major source of supplies to feed the public distribution system or buffer stocks. While procurement ensures intra-year price stability, stocks are mainly used to prevent inter-year price fluctuations arising out of short crops.
4.2.1 Temporal and Regional Dimensions of Procurement

Information on spatial and temporal aspects of procurement from 1965-66 to 1991-92, broken into triennia, is laid out in Appendix 4.3 (rice) and Appendix 4.4 (wheat).

There has been a sharp rise in the government procurement of rice and wheat since the introduction of new agricultural technology. Growth rates of procurement of both rice and wheat exceeded those of their respective outputs. Even as a ratio to production, procurement shows an uptrend in case of both the crops. The composition of procurement has also changed in favour of wheat over the years.

At regional level, Punjab, Haryana and Uttar Pradesh account for almost entire procurement of wheat (99.27 per cent in triennium ending 1988-89) though their share in output is

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1 From less than a million tonnes in triennium ending 1967-68, procurement of wheat rose to over 8 million tonnes in the triennium ending 1988-89. In 1989-90, wheat procurement has been over 9 million tonnes. Rice procurement rose from 3 million tonnes in the triennium ending (TE) 1965-68 to about 8 million tonnes in TE 1988-89. In 1989-90, rice procurement has been around 12 million tonnes.

2 Between 1969-70 and 1989-90, output of rice grew at an annual rate of 2.71 per cent while procurement recorded an increase of 6.52 per cent. Similarly for wheat, the growth rate in procurement was 5.67 per cent compared to growth rate in output of 4.59 per cent.

3 In case of wheat, from less than 2 per cent of output procured by government in 1966-67, the procurement went up to almost 23 per cent in 1976-77. However, after that the ratio reached a plateau except in 1985-86 when the government purchased 23.5 per cent of wheat output. During the three years ending 1989-90, the procurement has ranged between 14 to 18 per cent of output. The rise in the procurement ratio to its production has been more gradual for rice. Between 1966-67 and 1974-75, procurement has remained less than 10 per cent of output. In the subsequent years it showed a steady increase and reached a peak of about 17 per cent in 1984-85. See Appendix 4.5.

4 From a ratio of 13 : 87 in favour of rice in 1965-66, the ratio changed to 65 : 35 in favour of wheat in 1972-73. Thereafter, the ratio remained by and large in favour of wheat with the most notable exceptions of 1974-75 and 1975-76 when wheat procurement plummeted as a consequence of take over of wholesale trade as well as levy on wheat traders (Appendix 4.5).
only 69 per cent. The same three states were responsible for about 63 per cent of rice procurement in triennium ending 1988-89 with output share of only 23 per cent. These states with Andhra Pradesh and Tamil Nadu account for 91 per cent of rice procurement.\(^5\)

The ratio of rice procurement to production shows a sharp downtrend in Punjab and Haryana. In case of wheat as well, this ratio is tapering off in recent years.\(^6\) This decline seems to be due to widening gap between procurement price and open market price. Methods of rice procurement (levy, movement restrictions) may also have led to greater storage by farmers or traders for later sale.\(^7\) The ratio could have also declined due to avoidance and evasion of levy. Levy is avoided by switching over production to those varieties where levy rate is lower.\(^8\) Evasion of levy by under-reporting purchases and stocks is very common.\(^9\)

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\(^5\) In comparison, the contribution of Assam, Bihar, Orissa and West Bengal to rice procurement has sharply declined not only as a proportion to all-India procurement but also in absolute terms.

\(^6\) The regression results confirm a statistically significant decline in the ratio for rice in Punjab (-3.2 per cent; 1978-90) and Haryana (-2.4 per cent; 1968-90) and increase in Andhra Pradesh (3.6 per cent; 1966-90). Ratios for wheat show positive growth in Punjab (3.5 per cent) and Haryana (2.8 per cent) for the period 1967-68 to 1989-90 despite some decline in recent years.

\(^7\) Since traders may face stockholding restrictions, shortage of credit and transport problems, they may keep their stocks with farmers. Such stockholding behaviour causes a decline in the government share.

\(^8\) Till 1984-85, levy rate in Punjab and Haryana was 90 per cent on common and fine varieties and 75 per cent on superfine varieties. This could have partly induced a shift to superfine varieties of rice. Today, almost entire rice procured in Punjab is of superfine variety.

\(^9\) The rate of levy is often so high and price so unreumerative that millers find it worthwhile to evade levy. Evasion is particularly high in years when open market price and levy price differential is high. Subbarao (1978: 106) estimates the degree of under-reporting of stocks by rice
4.2.2 Institutional Arrangements, Systems of Procurement and Zonal Restrictions

Procurement is organised in different states by the government through FCI and state agencies.\(^\text{10}\) Procurement of wheat is made under price support operations at a uniform support/procurement price announced by the government in advance. Rice is mainly procured through levy on millers. The sale of wheat to the government is voluntary and the producers are free to sell in the open market. But sometimes movement restrictions are imposed to facilitate procurement, especially in years when open market price rules at a higher level than the procurement price.

Paddy is also purchased under price support operations if market price falls below support level which may happen if millers' demand for paddy is low. But FCI's paddy purchases

mills to be between 68.8 per cent and 71.7 per cent in 1971-72 in Andhra Pradesh. The levy system, however, suits millers as they can dispose of sub-standard rice to government agencies in whom they find an assured outlet.

\(^{10}\) FCI is the largest agency engaged in the task of procurement with an annual turnover of Rs 11,239 crore and a staff of 69,398 employees (in 1989-90). Purchases are made through more than 8,000 centres for wheat and 4,000 centres for paddy every year in the post-harvest season. After the requirements of the state governments are met, the surplus foodgrains are handed over to the FCI for the central pool. The FCI makes direct purchases from farmers/commission agents for the central pool or buys indirectly from state governments and reimburses them for the procurement price and other expenses. Since procurement is a state subject, it is the state governments which decide about the procurement agencies to be engaged, the number of centres to be allocated to state agencies and the FCI, the methods of procurement, systems of levy and levy price (with the central government's approval) as in case of rice. It is left to the respective agencies to arrange for the credit, transport and other paraphernalia required for procurement operations.

Credit for food procurement is arranged through the banking system as per public food procurement credit policy laid down by the RBI. Public food procurement agencies are exempted from all regulations of selective credit controls, movement restrictions, provisions of Essential Commodities Act besides enjoying the benefit of subsidised food credit from the commercial banks.
are relatively small. Paddy is largely purchased by millers who process it and sell a part of it as levy to the public agencies at procurement price. This price is fixed separately for each state depending on the price of paddy, variety, milling costs and out-turn of rice. The rate of levy varies from state to state and depends on production levels, local consumption requirements, availability of surplus and efficiency of rice milling industry.11

Several systems of procurement have been tried in the past.12 The main systems are briefly stated below:

1. Open market purchases under which the government appears as any other buyer and purchases are made without right of pre-emption or compulsion. The government outbids private traders to make purchases.13

2. Open market purchases with a right of pre-emption imply that the government does not bid directly but has the first right to purchase a specified share from the market at going market rate.14

3. Monopoly procurement under which farmers can sell only to public agencies at a fixed price. Since this drives out private trade from business, the government must have the resources to create market conditions for this system to work

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11 Rate of levy is high in states where own rice consumption is small (Punjab and Haryana: 75 per cent at present) than in predominantly rice-consuming states (Andhra Pradesh, surplus state: 50 per cent; West Bengal, deficit: 40 per cent).

12 Merits and demerits of different systems can be found in the reports of different committees on food policy referred in Chapter 1. A review of these systems also appears in Chopra (1981).

13 This system has been disfavoured by many for fear of inflation. See, for instance, India (1966) and Dantwala (1967).

14 See Dandekar (1967).
effectively.\textsuperscript{15} Tried in 1973, as takeover of wholesale trade in wheat, this system proved to be a fiasco.

4. Levy on producers or millers or traders is a fixed percentage of output produced or processed acquired by government at a fixed price. At present, it is being used only to procure rice mainly from millers. There is no levy of any kind on wheat. Also there is no levy on producers of paddy.\textsuperscript{16}

5. Requisitioning stocks from traders is the least used method of procurement. It can be used only in an extreme case.

6. Purchases at support price, which is the common mode of procurement in surplus states.

Government imposes restrictions on movements of rice and wheat, of one kind or the other, especially in years of shortages when the gap between support price and market price is wide. Although formally abolished in 1977, movement restrictions still exist in different forms.\textsuperscript{17}

\textsuperscript{15} There has been a general opinion that the government administrative machinery cannot handle the kind of quantities that are entailed in the system. When there is overall shortage of foodgrains, monopoly procurement of one commodity will induce farmers to withhold the supply of this commodity or divert it to other uses. The monopoly procurement system can be effective only if the government can purchase the entire marketed surplus of all foodgrains (see George, 1983: 41).

\textsuperscript{16} Since levy is a system of compulsory procurement, there is an element of coercion in it. Producers' levy is particularly resisted by farmers. It is also administratively difficult to implement and is politically unpopular. Levy on millers/traders is the common mode of rice procurement at present. Levy on wheat traders was also tried in 1974-75 (rate of levy was 50 per cent) but had to be soon given up as the traders successfully managed to evade levy by keeping their stocks with farmers.

\textsuperscript{17} During the 1992-93 marketing year of wheat, informal movement restrictions have appeared again. The government decided to ban rail movement of wheat by private trade and further issued instructions to check clandestine cross-border movement by traders in the name of farmers. These were besides other restrictions imposed such as credit squeeze on foodgrain dealers and reduction in stockholding limits.
Two types of zones have existed: single-state zones and large zones.\textsuperscript{18} Zoning reduces the market price in surplus areas by "bottling up" supplies. This keeps the gap between procurement price and market price low and facilitates procurement. Zoning acts as a conduit between surplus and deficit areas under the government auspices. But zoning has come in for much criticism. It is said that the market does the transfer business much better than the government.\textsuperscript{19}

Zonal restrictions result in farmers in surplus areas getting less price than their counterparts in deficit areas. This can have deleterious effects on long term growth prospects and may cause switching over to other crops where such restrictions do not exist.\textsuperscript{20} Low prices in surplus regions may drive out economic cultivation while high prices in deficit regions may encourage uneconomic cultivation. This is inefficient.

The movement restrictions also harm the small producers whose capacity to withhold stocks is limited. Producers with

\textsuperscript{18} In the former, a single state becomes the zone and grain is not allowed to move out of this state. This is more severe zonal arrangement than the larger zone system in which a group of states form a zone with permission of movement within the zone but not between the zones. Since 1964-65, government has been frequently changing the zonal policy. Single-state zones prevailed in 1964-65 to 1966-67, 1968-69 to 1969-70 and 1972-73 to 1974-75 and large zones in 1967-68. In other years, there were no zonal restrictions.


In another paper, Krishna and Raychaudhuri (1980) found that with zonal restrictions price dispersion increases, surplus producers earn less and deficit area consumers pay more than they otherwise would.

\textsuperscript{20} Such as from wheat to mustard in recent years. Subbarao (1978 a) also reports that zonal restrictions adversely affected incentives of paddy cultivators in Andhra Pradesh and led to switch over from paddy to sugarcane.
large surplus and traders in any case manage to bypass such restrictions.

4.2.3 Determinants of Procurement

The quantum of procurement depends on (1) farmers' capacity to sell (2) government's capacity to procure (3) farmers' willingness to sell and (4) government's willingness to procure. Each of these is explained below.

Farmers' capacity to sell is determined by the marketed surplus which is gross output minus retentions for seed, feed, wastage, payment of rent and wages in kind and, more importantly, home consumption minus stocks build-up. Marketed surplus of rice and wheat has been estimated using 'consumption by non-agricultural population' approach as per methodology explained in Appendix 2.15. Elasticity of marketed surplus with respect to output for rice and wheat exceeds unity.

Because of its statistical performance in the model, output rather than marketed surplus of the relevant commodity was used as an explanatory variable to reflect the farmers' capacity to sell. Marketed surplus was used in alternative OLS

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21 "Marketed surplus" could be more than "marketable surplus" if farmer's retention for self-consumption is less than his actual requirement. Conversely, if he retains more than his requirement, the marketed surplus would be less than marketable surplus. This may occur if he has an intention to withhold supplies for future sale or consumption (Sidhu, 1979).

22 Estimated elasticities for varying periods are as follows:

<table>
<thead>
<tr>
<th>Sample</th>
<th>Crop</th>
<th>Elasticity</th>
<th>Adj R</th>
<th>DW Stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>1965-90</td>
<td>Wheat</td>
<td>1.21</td>
<td>0.87</td>
<td>1.59</td>
</tr>
<tr>
<td>1974-90</td>
<td>Wheat</td>
<td>0.99</td>
<td>0.70</td>
<td>1.66</td>
</tr>
<tr>
<td>1975-90</td>
<td>Wheat</td>
<td>0.80</td>
<td>0.80</td>
<td>2.52</td>
</tr>
<tr>
<td>1965-90</td>
<td>Rice</td>
<td>1.04</td>
<td>0.87</td>
<td>1.30</td>
</tr>
<tr>
<td>1980-90</td>
<td>Rice</td>
<td>0.90</td>
<td>0.75</td>
<td>1.62</td>
</tr>
</tbody>
</table>

All elasticities are statistically significant at 1%.
equations reported separately in appendix tables.

The capacity to sell goes down in drought years due to decline in production and rise in demand for self-consumption and storage. In a drought year, the option of buying-back is not available as the market prices are generally high and availability low. Higher storage in drought years thus acts as an insurance cover. If the subsequent year happens to be a normal year, the previous year's stocks are released in the market thus raising the current year's supply. To reflect this phenomenon, one year lagged output is included as another variable. As in the open market price functions (Chapter 2), lagged supply was significant in explaining price level only in case of rice but not wheat. Similar result was obtained here; hence, in finally chosen equation, lagged supply was used only in rice equation.

Government's capacity to procure implies that for effective procurement, the government should not face any constraints of finance, storage capacity, transportation and administrative machinery. There is no evidence, however, that the government has faced any of these constraints. \textsuperscript{23} Hence, no attempt is made to quantify this variable.

Farmers' willingness to sell is conditioned by the prevailing price regime. The difference between procurement price and market price determines the agency to which farmers would decide to sell. In surplus regions in normal years, the

\textsuperscript{23} Government gets food procurement operations financed through a consortium of commercial banks; has adequate storage capacity of various types including cover-and-plinth; utilises the vast network of railways who provide preferential treatment to public agencies in moving foodgrains; and the FCI has enough experienced manpower to handle food procurement operations.
difference between the two prices is often not large enough to induce farmers away from government agencies. The narrow difference between the two prices may be partly a doing of government which imposes restrictions on movement of grains so that the market prices go down in relation to support prices and excess supplies are 'bottled up'.

The willingness to sell has been measured, in case of rice, by using ratio of procurement price to open market price and, in case of wheat, by taking these two prices separately, suitably deflated.

Government's willingness to procure may also determine the quantity procured. Government may be less willing to buy if its stock position is comfortable in relation to normal issues through PDS. Willingness to procure or the 'procurement effort' is reflected by the ratio of closing stocks to normal issues (defined as three years' moving average issues). Since it is relatively easier to procure wheat (especially through import) than rice, stock position may be more significant in determining willingness to procure rice than wheat.

An attempt was made to induct the effect of zoning through dummy variables (which equal unity in years when zoning was in force and zero when it was not so for rice and wheat, not distinguishing between single-state zones and large zones), but at all-India level results were not statistically significant.

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24 The difference of course widens in later months of the marketing year and the farmers can always decide not to sell immediately. However, their decision to withhold supply, in anticipation of selling it at a higher price in lean season, would be influenced by the costs of storage and anticipated price differential.
Monopoly procurement of wheat in 1973-74 followed next year by levy on wheat traders, were reflected through a dummy variable which takes the value of unity in 1973-74 and 1974-75 and zero in other years in wheat equations. Similarly, levy on rice millers and traders has been accounted for by computing weighted rate of levy by assigning procurement weights to state-level rates of levy.

However, institutional arrangements like zoning reflect in price levels in the open market. Zoning has operated differently in different states with varying levels of efficiency. More importantly, it has either been practically non-existent in most of the years under study or has been ineffective. It was, therefore, decided to exclude these variables from the all-India procurement functions. Based on above discussion, procurement functions of rice and wheat are

\[ RPAI = f \{ ROAI; ROAI -1; RPPTAP; RWILLP \} \quad \ldots \ldots \quad (9) \]
\[ WPAI = f \{ WOAI; WTAPRL; WPPRL \} \quad \ldots \ldots \quad (10) \]

where,

\[ RPAI \] = Procurement of rice (million tonnes).
\[ WPAI \] = Procurement of wheat (million tonnes).
\[ ROAI \] = Output of rice (million tonnes).
\[ WOAI \] = Output of wheat (million tonnes).
\[ RPPTAP \] = Ratio of procurement price index (RPPI) to twice-adjusted wholesale price index of rice (RTAPI).
\[ RWILLP \] = Ratio of opening stocks of rice to three years moving average PDS of rice.
\[ WTAPRL \] = Twice-adjusted wholesale price index of wheat (deflated by general price index (1970-71=100).
\[ WPPRL \] = Procurement price index of wheat deflated by general price index (1970-71=100).
4.2.4 Results and Discussion

Table 4.1 reports estimates of procurement functions for rice and wheat at all-India level. Procurement of wheat is significantly determined by capacity to sell (current output) and willingness to sell (deflated procurement price and deflated open market price). Equation yields a procurement elasticity of 1.04 with respect to output which is comparable to other studies. Elasticity with respect to open market price at -1.29 is higher than the procurement price elasticity of 0.81 implying much stronger (negative) effect of open market price on quantum of procurement of wheat. All the three variables are statistically significant at 1 per cent level. Equation as a whole explains 88 per cent of variation in dependent variable.

In case of rice, elasticity of procurement with respect to output is not only greater than unity (1.30) but also higher than that for wheat (1.04). Price variable, used as a ratio of procurement price and open market price, provides an elasticity estimate of 0.62 which is (unlike wheat) lower than the output elasticity and is significant at 10 per cent level. Output effect gets strengthened by inclusion of lagged rice output which gives an elasticity estimate of 0.92 and is statistically significant. In case of rice, willingness to procure (proxied by ratio of opening stocks to three years' PDS) turns out to be significant (at 5 per cent) and bears correct negative sign though its magnitude is low (-0.08). The equation explains 81 per cent of variation in rice procurement.

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25 OLS results may be seen in Appendix 4.6.
Table 4.1: Procurement Functions: Regression Results

<table>
<thead>
<tr>
<th>Eqn No</th>
<th>Period</th>
<th>Dependent Constant Variable</th>
<th>Independent Variables</th>
<th>Adj R Sq</th>
<th>DW Stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1970-89</td>
<td>WPAI</td>
<td>2.65</td>
<td>WQAI</td>
<td>0.20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>WTAPRL</td>
<td>-0.10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>WPPRL</td>
<td>0.07</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1970-89</td>
<td>RPAI</td>
<td>-10.75</td>
<td>ROAI</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>RPPTAP</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ROAI(-1)</td>
<td>0.11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>RMILLP</td>
<td>-0.65</td>
</tr>
</tbody>
</table>

Notes: (1) Figures within brackets are 't' values and within slashes elasticities at mean values.
(2) In case of wheat, marketing year and production year are different. For instance, for 1989-90 marketing year of wheat, the relevant production year is 1988-89. This has been taken care of while estimating procurement equations.
The state-level results (reported in Appendix 4.7 and based on OLS) reconfirm the importance of output and prices in determining quantum of procurement. In case of wheat, elasticity of procurement with respect to output is greater than unity in Punjab and Haryana but less than unity in Uttar Pradesh. Price variables are significant in Punjab and Haryana with open market price elasticity exceeding procurement price elasticity. In Uttar Pradesh, the two prices appear as a ratio which is significant. The price elasticities generally exceed output elasticities in the three states mentioned. Dummy variable for wheat trade take-over turns out to be significant (at 10 per cent level) in Punjab implying that wheat procurement declined during 1973-74 and 1974-75.

In case of rice, elasticity of procurement with respect to output is high but less than unity in all states except Uttar Pradesh. Price variables are significant in all the states except Tamil Nadu. In Uttar Pradesh, procurement of rice is also determined (besides output and price ratio) by zonal restrictions. In Andhra Pradesh and Tamil Nadu a dummy variable was incorporated in the equations to reflect sharp rise in public distribution and consequent pressure to procure more. The dummy variable is significant in both the states. Interestingly, output is not significant in determining procurement in Tamil Nadu or West Bengal; in the latter, even the sign is negative. The Tamil Nadu results are odd but agree with earlier studies by Krishna and Raychaudhuri (1980), Prabha (1983) and Poduval (1985). West Bengal case

26 Poduval (1985) explains this perverse behaviour in terms of lower pressure on PDS in good years (and low procurement) and high pressure during bad years (hence high procurement despite poor crop) besides lack
represents lack of effort on part of government to procure.

4.3 Public Distribution

It is not uncommon for governments in many countries, developed or developing, to provide in some form or the other, foodgrains, and other essential items of consumption, to the vulnerable sections of population, variously defined, at subsidised prices. In India, public distribution has been an important instrument in the management of food economy since 1939 when public distribution was initiated. It has now acquired a gigantic proportion and costs about Rs 3,000 crore to the exchequer in the form of explicit (budgeted) food subsidy.

The broad objectives of PDS in India have been three-fold:

(a) to provide minimum quantities of foodgrains to vulnerable consumers (with high income elasticity and low price elasticity) on a year-to-year basis so as to maintain per capita food availability and stabilise consumption in the face of variations in food production;

(b) to stabilise prices by supplying foodgrains through PDS at prices which are below market prices and thus act as an anchor to inflation;

(c) to transfer income to the low-income consumers to

of clear-cut storage policy.

27 In Egypt, for instance, food subsidy in 1980-81 amounted to nearly 20 per cent of its current expenditure and 7 per cent of its GDP (Scobie, 1988).

28 For evolutionary aspects of public distribution in India see Gupta (1977), Chopra (1981), George (1983) and Rana (1990). Almost all Committees appointed by the government to look into the food policy had examined the issues pertaining to public distribution. Reference to these Committees appears in Chapter 1 of this study.
raise their nutritional standards and thus act as an anti-poverty measure.

PDS has evolved from a tool of macro-economic management to an anti-poverty device.\textsuperscript{29} In recent years, anti-poverty stance of PDS has become more sharply focussed. Targetting is being debated, wage-employment programmes have been launched to ensure economic access to food through income transfers and there is renewed emphasis on backward (such as tribal) areas.

The subject of public distribution has been intensely debated. Most studies indicate that the performance of PDS has been short of expectations. Krishna (1967 a) concludes that foodgrain operations have failed to achieve their objectives. With clearly defined goals and better targetting of distribution, government could have achieved these objectives with less imports. Gupta (1977) highlights the lack of clarity about goals of PDS and ad hoc nature of food distribution programmes.

Some of the studies have proposed schemes of public distribution with estimated quantities required under varying assumptions.\textsuperscript{30} National Commission on Agriculture has estimated PDS requirement to be 12 million tonnes in 1975 (India, 1975).

Gulati and Krishnan (1975) have proposed a scheme of PDS

\textsuperscript{29} In the former, the main concern of the policy-makers is management of shortages and droughts, rationing, imports, ensuring availability in the face of fluctuations in output, checking food-inflation and keeping wage bills low. As an anti-poverty device, PDS aims at transferring incomes to low-income persons and the programme becomes more targetted towards poor persons and regions. It aims at raising nutritional standards of vulnerable groups of persons and ensuring household level food security.

\textsuperscript{30} For a review of some such studies see Bardhan (1975).
based on comprehensive coverage of the vulnerable sections. This covers about 51 per cent of total population in 1973. Using a norm of 280 gms per capita per day, they estimate the requirement to be 30.1 million tonnes in 1973. If one follows the ICMR consumption norm of 370 gms per capita per day, the figure goes up to 41.5 million tonnes.

Vyas and Bandyopadhyay (1975) have estimated PDS requirements under three scenarios covering (i) cities with population of 1 lakh and above; (ii) the entire urban population and (iii) the urban and non-cultivating rural population. The three estimates for 1975, based on economic demand for foodgrains, rather than normative demand, work out to 4.5 million tonnes, 10 million tonnes and 33.3 million tonnes respectively.

Gupta (1977: 238) has worked out PDS requirements (for maintaining the 1975 price levels) on the basis of certain assumptions regarding the sequencing of conditions of three monsoons in 1976, 1977 and 1978 and rate of change in income. The requirement ranges in 1978 from 15.61 million tonnes to 46.63 million tonnes depending on the scenario.

The focus in some other studies is not so much on estimating quantities required for distribution but on the cost-benefit analysis and functioning of PDS. George (1988) has found that the benefit cost ratio of PDS is favourable at 1.63 considering direct fiscal cost and benefits in the form of ration income (i.e. saving to consumers at open market prices). The ratio goes down to 1.16 if indirect costs are also considered.

Krishna and Chhibber (1983) have estimated the PDS demand
for wheat to be around 8-9 million tonnes a year for a decade. If current operating rules continue, the cost will be quite heavy. However, the losses can be reduced if the government rationalises the imports that may be required in some years and cuts average inventory down to about one-fourth of its present size, though never to less than one fourth of issues.

The urban-bias of public distribution and consumption of PDS supplies by non-poor has also been highlighted by many studies. In a recent study, Bapna (1990) has concluded that major proportion of foodgrains was distributed in urban areas and that the very poor could not take advantage. He supports this finding with some micro-studies. Several other studies have also come to similar conclusions.31 Some recent studies have, however, expressed contrary views and have found rural-bias in PDS.32

On the effects of PDS on household food consumption, George (1985) estimated that the consumption of the poorest Indian consumers went up by 18 per cent due to public distribution. Kumar (1979) found that the weight for age of children in Kerala would fall by 8 per cent if PDS was abolished. The empirical evidence on the effects of PDS on inflation, output, employment, trade, wages etc is hard to come by in the Indian context.

This section aims at (a) analysing the temporal and regional trends in public distribution of rice and wheat and (b) formulating and estimating the offtake functions.


4.3.1 Trends in Public Distribution

The average quantity of rice and wheat distributed through fair price shops during 1965-67 was about 9 million tonnes (18.6 per cent of net availability) which went up to 15.8 million tonnes during 1988-90 (15 per cent). Wheat distribution accounted for as much as 42.5 per cent of its availability in 1965-67 and rice 11.2 per cent. During 1988-90, the share of wheat distribution in availability was 17.3 per cent and that of rice 14.5 per cent. Total public distribution has recorded significant increases since 1980, largely contributed by rice. The share of wheat in total distribution, declined from 66 per cent in 1965-67 to 45 per cent in favour of rice in 1988-90.

Statewise distribution shows that Kerala, Maharashtra,

33 Besides rice and wheat, some coarse cereals are also distributed through the fair price shops. However, their share is negligible and widely fluctuating. Only in 1973 and 1974 significant quantities of coarse grains were distributed. Bulk of coarse grains go to Maharashtra and Gujarat.

34 The total public distribution figures, as given in the official documents, also include (in case of wheat) quantities distributed to the roller flour mills (RFMs) and (since 1978) distribution under rural employment programmes. Both these are not strictly public distribution but their share (especially of RFMs) in total public distribution is large. The analysis in this section excludes these two items except where specifically stated.

35 This is because of large-scale imports of wheat under PL 480 which were the main source of supply for public distribution in this period. In 1965, for example, imports of rice and wheat accounted for over 77 per cent of their total distribution.

36 For handling the growing quantities of public distribution, the number of fair price shops has also been increased significantly. As against 1,02,000 shops in 1965 there were as many as 3,58,490 shops in 1990. The number of persons per shop declined from about 8,000 to 2,334 over the said period. The quantity of foodgrain distributed per shop also shows a declining trend indicating thin spread of supplies and, perhaps, erosion in the viability of fair price shops.
Tamil Nadu, West Bengal and Delhi are significant recipients of foodgrains. Their combined share in rice and wheat distribution was about 48 per cent in 1990 though their share in the population below the poverty line was only 26 per cent in 1987-88. In contrast, shares of Bihar, Madhya Pradesh, Rajasthan, Orissa and Uttar Pradesh are relatively small. Together they shared less than 16 per cent of rice and wheat though their share in the poor population was about 52 per cent. Correlation between shares in PDS and shares in population below poverty line across states is as low as 0.25. But correlation is high with respect to shares in urban population (0.56) implying urban bias in PDS.

In terms of commodities, rice is largely shared by Andhra Pradesh, Kerala, Tamil Nadu and West Bengal whose combined share in 1990 was over 56 per cent. Distribution of wheat is a little more spread out but Maharashtra, West Bengal and Delhi have a combined share of over 40 per cent.

The regional dimension of public distribution is laid out in Appendices 4.8, 4.9 and 4.10.

Per capita distribution of cereals (rice and wheat) increased from 17.22 kgs in 1973-74 (average of calendar years 1973 and 1974) to 21.74 kgs in 1988-89. Distribution of wheat registered a decline from 11.16 kgs to 10.14 kgs but was more than compensated by increase in distribution of rice from 6.06 kgs to 11.6 kgs over the same period. However, there are state-level differences.

For some states, contribution of PDS in per capita consumption is quite high reflecting high degree of dependence on centre for food supplies. This degree of dependence has
been estimated at two points of time, 1973-74 and 1988-89, and is defined as per capita distribution as per cent to per capita consumption of rice and wheat. As shown in Table 4.2, there are vast inter-state differences in the degree of dependence. Nearly half of consumption in Kerala and Maharashtra in 1973-74 was contributed by public distribution. Between the two points of time, some states show sharp increase in dependence (most notably Tamil Nadu) while others show a decline (sharpest being in Maharashtra).

Since 1978, distribution of foodgrains under employment programmes has been quite significant though varying from year to year. Between 1979 and 1990 a quantity of 9 million tonnes of wheat and 3.4 million tonnes of rice was distributed under these programmes or about one million tonnes per year (Appendix 4.11).

Wheat accounts for almost 73 per cent of total distribution under these programmes. As a result, bulk (61 per cent) of foodgrains was distributed in wheat-consuming states like Uttar Pradesh, Rajasthan, Bihar and Madhya Pradesh. The positive side of it is that it neutralised the bias against these states in PDS noted earlier. Wheat distribution during 1979 to 1990 under these programmes averaged 9.7 per cent of total wheat distributed under PDS. Corresponding figure for rice was 3.7 per cent. In 1987, over 33 per cent of wheat under PDS was distributed through employment programmes. The previous drought of 1979-80 also saw large quantities of both wheat and rice being distributed through these programmes.

Droughts have been a major reason for higher distribution of grains through these programmes as well as through normal
<table>
<thead>
<tr>
<th>States</th>
<th>Rice and Wheat</th>
<th>Wheat</th>
<th>Rice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andhra Pradesh</td>
<td>7.81</td>
<td>143.16</td>
<td>5.46</td>
</tr>
<tr>
<td>Assam</td>
<td>16.00</td>
<td>147.72</td>
<td>10.83</td>
</tr>
<tr>
<td>Bihar</td>
<td>7.55</td>
<td>148.68</td>
<td>5.08</td>
</tr>
<tr>
<td>Gujarat</td>
<td>18.09</td>
<td>88.08</td>
<td>20.54</td>
</tr>
<tr>
<td>Haryana</td>
<td>13.43</td>
<td>139.56</td>
<td>9.62</td>
</tr>
<tr>
<td>Himachal Pradesh</td>
<td>12.19</td>
<td>116.20</td>
<td>10.31</td>
</tr>
<tr>
<td>Karnataka</td>
<td>9.19</td>
<td>79.92</td>
<td>11.50</td>
</tr>
<tr>
<td>Kerala</td>
<td>45.71</td>
<td>95.16</td>
<td>48.03</td>
</tr>
<tr>
<td>Madhya Pradesh</td>
<td>6.12</td>
<td>134.40</td>
<td>4.55</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>39.02</td>
<td>60.24</td>
<td>49.83</td>
</tr>
<tr>
<td>Orissa</td>
<td>11.55</td>
<td>159.48</td>
<td>7.24</td>
</tr>
<tr>
<td>Punjab</td>
<td>16.12</td>
<td>125.40</td>
<td>12.85</td>
</tr>
<tr>
<td>Rajasthan</td>
<td>8.53</td>
<td>103.80</td>
<td>8.22</td>
</tr>
<tr>
<td>Tamil Nadu</td>
<td>8.88</td>
<td>129.12</td>
<td>6.88</td>
</tr>
<tr>
<td>Uttar Pradesh</td>
<td>7.28</td>
<td>139.56</td>
<td>5.22</td>
</tr>
<tr>
<td>West Bengal</td>
<td>39.52</td>
<td>129.12</td>
<td>30.61</td>
</tr>
<tr>
<td>ALL INDIA</td>
<td>17.22</td>
<td>116.40</td>
<td>14.79</td>
</tr>
</tbody>
</table>

Notes: Figures under "PDS" are per capita quantities (kgs/year) distributed under the PDS while under "NSS" represent per capita consumption (in kgs) based on NSS rounds conducted in the relevant years. The % indicates share of PDS in consumption.
FPS network. Droughts affect public distribution in two major ways. Firstly, by reducing supplies they increase the rural demand for public distribution. Secondly, lowered supplies raise the open market prices and the gap between open market price and issue price widens causing an increased pressure on PDS. This leads to a sharp depletion in stocks and/or imports. Effective management of droughts, which has been a major achievement of PDS, largely depends on stock depletion which has contributed in 1987 to as much as 74 per cent of total PDS supplies of wheat. In other drought years, this percentage has been normally around 30-40 per cent. This is in sharp contrast to the sixties when imports played a major role.

A peculiar, and perhaps least discussed, feature of the PDS has been allocation of large quantities of wheat to the roller flour mills (RFMs) at, or in some years a little higher than, issue price but lower than open market price, involving a subsidy. Peculiar because this industry, which drew concessional supplies from the government, was under no obligation to supply the end-product (wheat flour) at concessional prices. Even in years when the government faced shortages, the supplies to this industry were maintained. Their share in total PDS of wheat has been more than 40 per cent in 11 out of 22 years. In some years, the share has exceeded 55 per cent (Appendix 4.12).

The official rationale of this policy was that this industry was totally dependent on wheat production and therefore should be treated along with PDS. This also helped FCI in rolling over its old stocks, unsuitable for PDS, thus
providing a captive outlet. Mills were in fact prohibited from making open market purchases for which they were compensated by sale of wheat at concessional prices. Distribution of wheat to RFMs, which has been more in non-wheat producing areas, helped popularising wheat in these areas and also in evening out regional disparities in availability of wheat products. States with large shares of wheat allocation for RFMs included Maharashtra, Tamil Nadu, West Bengal and Delhi and, since 1977, Karnataka, Andhra Pradesh, Assam and Bihar.

Since September 1986, the government has done away with the system of allocation of wheat to RFMs at concessional prices. The RFMs are now expected to buy wheat through open sales of FCI at prices fixed for the purpose. Though these prices are not as concessional as issue price, they still contain an element of subsidy as these are less than the economic cost to FCI.

One of the goals of PDS has been to transfer income to low-income consumers through subsidised foodgrains. What is the income impact of PDS? To answer this question information is required on (a) the fraction of income spent on (subsidised) cereals; (b) the fraction of cereal consumption that is subsidised; and (c) the extent of subsidy i.e the percentage difference between open market and subsidised prices (Chakrabarti, 1977: 32).

Using this information for 1986-87, income effect of PDS for rice and wheat has been worked out (Table 4.3). Evidently, the overall income effect is quite small. Yet it is higher at low income levels than in high income groups. Therefore, distribution of grains to poorer groups will be more effective
Table 4.3: Income Effect of the Public Distribution System, 1986-87

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Rice/Wheat</th>
<th>Rural Expenditure Groups</th>
<th>Urban Expenditure Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>I</td>
<td>II</td>
</tr>
<tr>
<td>(1) Fraction of income spent on</td>
<td>Rice</td>
<td>0.23</td>
<td>0.22</td>
</tr>
<tr>
<td>income spent on</td>
<td>Wheat</td>
<td>0.10</td>
<td>0.08</td>
</tr>
<tr>
<td>(2) Fraction of consumption subsidised</td>
<td>Rice</td>
<td>0.16</td>
<td>0.17</td>
</tr>
<tr>
<td>consumption subsidised</td>
<td>Wheat</td>
<td>0.10</td>
<td>0.13</td>
</tr>
<tr>
<td>(3) Extent of subsidy</td>
<td>Rice</td>
<td>0.37</td>
<td>0.37</td>
</tr>
<tr>
<td>extent of subsidy</td>
<td>Wheat</td>
<td>0.31</td>
<td>0.31</td>
</tr>
<tr>
<td>Income Effect</td>
<td>Rice</td>
<td>1.35</td>
<td>1.34</td>
</tr>
<tr>
<td>(Per cent)</td>
<td>Wheat</td>
<td>0.30</td>
<td>0.34</td>
</tr>
</tbody>
</table>

Notes: (1) Fraction of income spent on rice/wheat is taken from the 42nd NSS Round on Consumption Expenditure.
(2) Fraction of consumption of rice and wheat subsidised is calculated from the 42nd Round of NSS on Utilisation of Public Distribution System.
(3) Extent of subsidy is calculated as difference between retail price and PDS price as ratio to PDS price. The former is taken from Agricultural Prices in India and the latter from the NSS Report on Utilisation of Public Distribution System. The extent of subsidy is assumed to be same across expenditure groups.
(4) Expenditure group I represents 0-10 and 10-20 fractile expenditure groups, Group II covers 20-30 and 30-40, Group III represents 40-50, 50-60 and 60-70, and Group IV stands for 70-80, 80-90 and 90-100.
and calls for income-based targeting. Effect on urban consumers is much smaller (as they spend lower fraction of their income on cereals) than on rural consumers. Income effect on rice consumers is more than on wheat.

On the whole, the fraction of income spent on rice and wheat is generally small and their subsidised distribution has little income effect. But if one includes coarse cereals, the fraction of income spent on cereals goes up, especially at low-income levels, but since distribution of coarse grains through PDS is negligible, the income effect is not likely to be significant.

Urban bias in PDS in most states (except Kerala) has been the finding of many studies (Tyagi, 1990; India, 1979; George, 1985; Suryanarayana, 1985; Bapna, 1990). However, recent studies by Ahluwalia (1991 a) and Dev and Suryanarayana (1991) express views to the contrary and find rural bias in PDS. Both these studies make use of the NSS Round on Utilisation of the Public Distribution System (1986-87). Using the same information, Howes and Jha (1992) conclude that there is urban bias.

The two sets of studies differ basically in the meaning of bias. While Dev and Suryanarayana use total purchasers (whether from the PDS or market or both) as the denominator, Howes and Jha use total rural and urban population. An appropriate denominator, however, is rural and urban poor (defined in terms of official poverty line) which will capture the element of need in PDS. As shown in Table 4.4, the PDS quantities purchased per poor person is more in urban areas than in rural areas. This is true of both rice and wheat.
<table>
<thead>
<tr>
<th>State</th>
<th>PDS Purchases (Rice; th. kgs)</th>
<th>PDS Purchases (Wheat; th. kgs)</th>
<th>Poor Popln (million)</th>
<th>Rice per cap. (kgs/ppwy)</th>
<th>Wheat per cap. (kgs/ppwy)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rural</td>
<td>Urban</td>
<td>Rural</td>
<td>Urban</td>
<td>Rural</td>
</tr>
<tr>
<td>Andhra Pradesh</td>
<td>113800</td>
<td>26709</td>
<td>490</td>
<td>3153</td>
<td>15.31</td>
</tr>
<tr>
<td>Assam</td>
<td>9992</td>
<td>2329</td>
<td>524</td>
<td>14</td>
<td>5.04</td>
</tr>
<tr>
<td>Bihar</td>
<td>1235</td>
<td>169</td>
<td>2756</td>
<td>2854</td>
<td>30.03</td>
</tr>
<tr>
<td>Gujarat</td>
<td>11562</td>
<td>2958</td>
<td>14097</td>
<td>6047</td>
<td>5.62</td>
</tr>
<tr>
<td>Haryana</td>
<td>172</td>
<td>219</td>
<td>0</td>
<td>0</td>
<td>1.35</td>
</tr>
<tr>
<td>Himachal Pradesh</td>
<td>4011</td>
<td>214</td>
<td>1243</td>
<td>26</td>
<td>0.84</td>
</tr>
<tr>
<td>Karnataka</td>
<td>20592</td>
<td>16342</td>
<td>6134</td>
<td>5196</td>
<td>10.28</td>
</tr>
<tr>
<td>Kerala</td>
<td>81467</td>
<td>16953</td>
<td>7616</td>
<td>2276</td>
<td>3.74</td>
</tr>
<tr>
<td>Madhya Pradesh</td>
<td>5994</td>
<td>3481</td>
<td>7460</td>
<td>3354</td>
<td>19.4</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>16641</td>
<td>14521</td>
<td>28341</td>
<td>17529</td>
<td>16.69</td>
</tr>
<tr>
<td>Orissa</td>
<td>737</td>
<td>123</td>
<td>688</td>
<td>946</td>
<td>12.42</td>
</tr>
<tr>
<td>Punjab</td>
<td>0</td>
<td>198</td>
<td>148</td>
<td>9</td>
<td>0.96</td>
</tr>
<tr>
<td>Rajasthan</td>
<td>501</td>
<td>688</td>
<td>26699</td>
<td>1963</td>
<td>8.06</td>
</tr>
<tr>
<td>Tamil Nadu</td>
<td>39440</td>
<td>17557</td>
<td>3514</td>
<td>4571</td>
<td>13.84</td>
</tr>
<tr>
<td>Uttar Pradesh</td>
<td>7606</td>
<td>3456</td>
<td>7744</td>
<td>4283</td>
<td>37.31</td>
</tr>
<tr>
<td>West Bengal</td>
<td>21670</td>
<td>21657</td>
<td>19529</td>
<td>24668</td>
<td>13.72</td>
</tr>
<tr>
<td>ALL INDIA</td>
<td>358090</td>
<td>146161</td>
<td>129932</td>
<td>101314</td>
<td>195.97</td>
</tr>
</tbody>
</table>

Notes: Figures on quantity purchased are from the Report of the NSS 42nd Round on Utilisation of Public Distribution System (1986-87). Information on the number of rural and urban poor is from Planning Commission.
Kerala stands apart with significant rural bias. Urban bias is also not so strong in Andhra Pradesh and West Bengal for rice.

4.3.2 Determinants of Offtake

Offtake of rice and wheat is influenced, among other things, by the difference between issue price and open market price. The higher the issue price in relation to open market price, the lower the pressure on PDS and vice versa. The ratio of issue price to open market price is thus negatively related to offtake. The right prices to take are the retail open market price and retail issue price. But no reliable time series on these two sets of prices are available. Since retail prices are by and large likely to move in the same direction as wholesale prices, taking wholesale prices is not inappropriate.

Offtake is further explained in terms of buying capacity of consumers. In Indian situation, an increase in average income will raise demand for foodgrains both in PDS and open market. Paying capacity is thus positively related to offtake from PDS. Real private final consumption expenditure has been used as the relevant variable.

Offtake is generally less in years of good rainfall, especially the rural offtake. Even otherwise, better output reduces the pressure on open market prices and the gap between the two prices narrows down leading to a reduction in offtake. In a drought year, the pressure on PDS mounts not only in urban areas due to larger price gaps but also in rural areas due to lowered supplies. This is reflected by including a dummy variable on drought which takes the value of unity in years of drought and zero otherwise.
Finally, lagged offtake has been included to reflect trend variable. This is a proxy for factors such as food availability, urbanisation, poverty levels, level of food deficit etc. or, in other words, all those factors which determine the long term level of issues.

On the basis of previous discussion, offtake functions for rice and wheat are as under

\[ \text{RPDS} = f \left( \text{ISWSRR}; \text{PFCE}; \text{DROUT}; \text{RPDS} -1 \right) \quad \ldots \ldots \quad (11) \]
\[ \text{WOFT} = f \left( \text{ISWSRW}; \text{PFCE}; \text{DROUT}; \text{WOFT} -1 \right) \quad \ldots \ldots \quad (12) \]

where,

\[ \text{RPDS} = \text{Public distribution of rice (Oct-Sept), million tonnes.} \]
\[ \text{WOFT} = \text{Offtake of wheat from fair price shops (Apr-Mar), million tonnes.} \]
\[ \text{ISWSRR} = \text{Ratio of issue price to open market price of rice.} \]
\[ \text{ISWSRW} = \text{Ratio of issue price to open market price of wheat.} \]
\[ \text{PFCE} = \text{Private final consumption expenditure (Rs crore, at 1980-81 prices).} \]
\[ \text{DROUT} = \text{Dummy variable } = 1 \text{ in drought years and } = 0 \text{ in others.} \]

4.3.3 Results and Discussion

Estimates of offtake functions for rice and wheat are reported in Table 4.5. Results show that offtake of rice is significantly influenced by paying capacity (proxied by PFCE) with an elasticity estimate of 1.12 significant at 1 per cent level. Dummy variable on drought is also significant at 1 per cent level suggesting that offtake is higher in drought years. Price ratio, an indicator of substitution between concessional market and open market, provides -0.29 as the elasticity estimate but is not significant at 10 per cent level of significance. Lagged dependent variable is significant at 10

37 OLS estimates may be seen in Appendix 4.13.
Table 4.5: Offtake from PDS: Regression Results

<table>
<thead>
<tr>
<th>Eqn No</th>
<th>Period</th>
<th>Dependent Variable</th>
<th>Constant</th>
<th>Independent Variables</th>
<th>Adj R Sq</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PFCE ISWSRR DROUT RPDS(1)</td>
<td></td>
</tr>
<tr>
<td>(1)</td>
<td>1970-89</td>
<td>RPDS</td>
<td>-0.76</td>
<td>0.00006 -0.02 0.87 0.26</td>
<td>0.87</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(-0.58)</td>
<td>(4.84) (-1.65) (4.90) (1.87)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>/1.12/ /-0.29/ /0.25/</td>
<td></td>
</tr>
<tr>
<td>(2)</td>
<td>1970-89</td>
<td>WDFT</td>
<td>9.40</td>
<td>0.00002 -0.09 1.98 0.39</td>
<td>0.59</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(6.38)</td>
<td>(3.55) (-7.15) (11.82) (5.10)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>/0.40/ /-2.11/ /0.38/</td>
<td></td>
</tr>
</tbody>
</table>

Note: Figures within brackets are 't' values and within slashes elasticities at mean values.
per cent. Equation as a whole explains 87 per cent of variation in rice offtake.

Offtake of wheat is significantly determined by ratio of issue price and market price. This variable is significant at 1 per cent level and yields an elasticity estimate of -2.11. Purchasing capacity (proxied by PFCE) is significant at 1 per cent level with an elasticity of 0.40. Drought puts a pressure on wheat offtake as revealed by significant dummy variable. Magnitude of this variable is higher compared to rice, indicating that in a drought year pressure on PDS supply of wheat is more than that of rice. Lagged dependent variable is also significant at 1 per cent level indicating strong trend effect. Equation as a whole explains 69 per cent of variation in offtake of wheat which is somewhat low.

In general, it may be noted that price ratio plays a more dominant role in the offtake of wheat compared to rice. This is expected. The wedge between issue price and market price is much larger in rice implying that switching over to free market will require much larger increase in issue price. In other words, a small increase in issue price will not shift consumers from PDS to open market, hence low (and insignificant) elasticity.

Situation in wheat is different. Issue prices are not much lower than open market prices. In fact, there have been many years when wholesale prices have been less than issue price. The price wedge being small in wheat, even a small change in issue price will induce large shift to open market. That is why in case of wheat, elasticity with respect to price ratio is higher.
Expenditure elasticities of rice and wheat offtake also differ significantly. Compared to 1.12 for rice, expenditure elasticity was a low 0.40 in case of wheat. It implies that demand for concessional rice would rise much more in response to a change in income level than would demand for concessional wheat. This is plausible considering high incidence of poverty among rice-consumers with large unsatisfied demand for rice.

4.4 Public Stock Operations

Storage is a normal trading activity. However, the motives of private and public storage differ. Private traders store in anticipation of making profit from off-season rise in prices. They match the storage costs with the ex ante rise in prices and make the storage decisions. Public storage, on the other hand, aims at reducing instability in prices and uncertainty of availability over a period. It tries to reduce the off-season price-rise, which in fact is the very basis of private storage. In this sense, public storage acts as a countervailing force to the storage activities of private traders.

Public storage could be of three types: seasonal storage, annual storage and excess storage. However, this is only a conceptual classification and not physically separate entities.

Seasonal Storage: This kind of storage ensures inter-season (or intra-year) supplies of grains. It supplies grains from a surplus season to a deficit one. The need for seasonal storage arises because supplies come at a particular period (post-harvest) while the consumption demand is spread over the year. Smooth-flow of supplies throughout the year can be ensured
through releases from government stocks either in the open market or through public distribution system. In India, it is generally the latter. These releases aim at normalising supplies during the year to match the demand. These stocks are called "operational stocks".

**Annual Storage:** The function of this storage is to ensure supplies from a surplus year to a deficit one. Food production is typically unstable from year to year. Production variability is partly caused by weather which cannot be anticipated. Thus to maintain year to year food availability and to prevent undue rise in prices caused by production shortfalls, the public agencies undertake inter-annual storage (or "bufferstocks"). As the name suggests, these stocks are kept for more than a season, generally more than a year or two. A private trader normally does not store beyond a season which makes bufferstocking a typically public activity. But seasonal storage is undertaken both by public and private agencies.

**Excess Storage:** Public agencies may sometimes hold stocks which are over and above seasonal and annual stocks. This occurs because of the government policy to procure unlimited quantity of grains at support/procurement prices. Since the government cannot back out in years of high production, it is left with more stocks than it requires to even out seasonal or annual variability in supply and prices. These "excess stocks" are kept at a high cost without any commensurate benefits.

Any variation in production must translate itself into variation in any, or a combination, of these three components: (a) stocks (b) imports and (c) consumption. Since a reduction
in consumption will not be politically acceptable. It is the variation in the remaining two which offers a practical solution. Stocks and imports are in a sense substitutes though it is a matter of policy how much reliance government wants to place on stocks and how much on imports. Since India pursues a policy of self-sufficiency, the greater burden of adjustment falls on stocks.

4.4.1 Views on Optimum Level of Stocks

The need for maintaining public stocks of foodgrains to even out fluctuations and to provide insurance against scarcity in bad years has long been recognised. How much public storage is adequate to achieve price stability and what level should trigger imports, has been examined by many experts. Too little storage creates a psychology of shortages and can raise prices. Excessive storage, on the other hand, can be costly. By narrowing down seasonal price fluctuations, it also reduces (or, in an extreme case, eliminates) private storage. Attempts to overstabilise prices (i.e. reduction in normal seasonal price fluctuations) will not only reduce private purchases but also force public agencies to procure more and incur more losses. The purpose of public storage is not to eliminate

38 See for instance, the Report of the Foodgrain Policy Committee, 1943 which recommended a stock of not less than 5 lakh tonnes. Foodgrain Policy Committee, 1948 also recommended a stock of 1 million tonnes. Foodgrains Enquiry Committee, 1957 suggested a separate organisation which would maintain a reserve of 2 million tonnes. The Foodgrains Policy Committee, 1966 recommended a bufferstock of 4 million tonnes. Most Committees envisaged the stocks to be created out of imported grains as the domestic procurement was not adequate for the purpose.

39 In Indonesia, excessive storage by BULOG led to narrowing of seasonal price fluctuations which made private storage and transport unattractive. This threatened the existence of private trade and BULOG found itself performing storage functions at high cost and holding large inventories (see Piggott and Treadgold, 1991). In the Indian context, Sidhu (1979:87) observed that the government entry into the market
private traders but to moderate their activities.⁴⁰

It was not until the setting up of the Technical Group in December, 1975 (Chairman: GCL Joneja) that a systematic treatment to the subject was given. The Group recommended a bufferstock of 12 million tonnes over and above operational stocks which should range between 3.5-3.8 million tonnes on 1st April of the year and 8.2-8.8 million tonnes on 1st July.

Another Technical Group constituted in April 1981 (Chairman: BC Gangopadhyay) recommended a bufferstock of 10 million tonnes comprising 5 million tonnes each of rice and wheat. This was in addition to operational stock which was to range between 6.5 million tonnes (on 1st April) and 11.4 million tonnes (on 1st July). The total stocks together should range from 16.5 million tonnes to 21.4 million tonnes at different points of time. Besides, a small baseline stock of 1.2 million tonnes of wheat and 1 million tonnes of rice was also suggested. The Group based its recommendation on the gap between level of distribution and procurement of foodgrains. Assuming that the production shortfall spills over two years, it suggested a bufferstock equal to twice the gap between maximum distribution and minimum procurement over the last five years. In a note of dissent, one of the members of the Group disagreed with the majority finding as an attempt to seek complete risk aversion which was possible if resources were abundant.

overstabilised prices and made the marketing system very rigid and insentitive to conditions of demand and supply.

⁴⁰ Government's inability to moderate seasonal price rise in wheat during 1991-92 marketing year led to a sharp drop in public procurement while private purchases and storage increased significantly.
Commenting on the targets of public stocks of grains recommended by various official committees, Krishna and Chhibber (1983:17) commented that these targets "have been usually inoperative as ex ante goals, for the actual amounts stocked have been residuals passively determined by imports-constrained by foreign exchange availability and other things-and domestic procurement and issues, governed by domestic supply and prices." Most Committees, they feel, have only rationalised the existing stocks as the target stocks.

4.4.2 Trends in Stocks: Actual and Desired

Total stocks held by government have been rising over time. This reflects rising supply through domestic procurement and the need to keep higher stocks to cater to the growing demand for PDS. Even when production and price variability remains unchanged, total stocks held would rise due to rise in demand for PDS. These stocks are pro-cyclical in nature i.e. these are highest when the gap between potential and actual production is lowest and are lowest when the output gap is highest. One of the objectives of stocks is to smoothen these cyclical changes in output.

Total stocks consist of baseline stocks, buffer stocks (including excess stocks) and operational stocks. Since the requirement of operational stocks varies from month to month, the level of total stocks also must vary. Just before the start of harvest of a given crop, its stocks would be low (due to near depletion of operational stocks) and the stocks would be highest soon after the procurement is over. By and large, the lowest point for wheat occurs in March and for rice in October. Highest points occur in July and January for wheat.
and rice respectively. Because of this, the stocks as on 1st July comprise, besides baseline and bufferstocks, PDS requirement of wheat for 12 months and that of rice for 6 months. On 1st January, stocks must provide for 12 months of rice requirement and 6 months of wheat.

Following the Technical Group of 1975, desired stocks were estimated by using:

\[ S^* = A + n (g) + t (d) \]

where \( S^* \) is the desired stocks, \( A \) is the baseline stock, \( n \) is the number of years for which food security stocks are required, \( g \) is the maximum gap between procurement and distribution during the previous five years, \( t \) is the number of months for which PDS requirement is to be provided for and \( d \) is the average monthly offtake from PDS. Baseline stocks have been taken at 1 million tonnes each for rice and wheat. Only a single year's food security is provided for. PDS needs for 12 months are provided for so that \( S^* \) becomes the peak stock on 1st July for wheat and on 1st January for rice.

Also estimated are \( S^{**} \) in which bufferstocks are estimated as equal to the five yearly standard deviation of deviations of actual output from trend.\(^{41}\) This provides security in 2 out of 3 years. If security is desired for 19 out of 20 years then twice the standard deviation should be

---

\(^{41}\) The trend equations are as follows:

\[
\begin{align*}
\text{WDAI} & = 7.87 + 1.61 \, t \\
& \quad (26.68) \quad \text{Period: 1965-90} \\
& \quad \text{Adj R Sq}=0.96 \quad \text{DW}=1.72
\end{align*}
\]

\[
\begin{align*}
\text{ROAI} & = 29.98 + 1.30 \, t \\
& \quad (11.08) \quad \text{Period: 1965-90} \\
& \quad \text{Adj R Sq}=0.82 \quad \text{DW}=1.95
\end{align*}
\]

where, WDAI and ROAI are wheat and rice output at all-India level and \( t \) is time.

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taken (because 95 per cent of deviations lie within 2 SD). But then the level of stocks would be too high to be justified on economic grounds.

The target stocks thus obtained (both $S^*$ and $S^{**}$) are compared with actual stocks in Table 4.6. Since stocks emerged only somewhere in the mid-seventies, a fair comparison should begin from then. It is interesting that notwithstanding the scientific formulations of the official committees, the actual stocks differ from the target stocks by substantial margins, notably for rice.

Actual behaviour of stocks belies all stocking principles laid down by various Committees. Government has accepted much higher stocks of wheat during 1985-87 and much lower in 1981, 1988 and 1989. In case of rice, actual stocks have been far below desired levels although, going by output fluctuations, rice stocks should have been kept at a higher level than those of wheat.

Efforts to put bufferstocks or peak stocks in a behavioural equation failed to yield statistically significant results. In view of this, closing stocks with government are treated as residual, determined through an identity while imports are treated as exogenous variable. The stock identities are

$$RCST9 = RCST9(-1) + RPAI + NIMPR - RPDS + RBAL \quad \ldots (15)$$

$$WCST3 = WCST3(-1) + WPAI + NIMPW - WPDS + WBAL \quad \ldots (16)$$

where,

$RCST9 = $ Closing stock (end September) of rice with government.
$WCST3 = $ Closing stock (end March) of wheat with government.
$RPAI = $ Procurement of rice.
<table>
<thead>
<tr>
<th>Year</th>
<th>Rice Stocks (1st January)</th>
<th>Wheat Stocks (1st July)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$#$</td>
<td>$###$</td>
</tr>
<tr>
<td>1965</td>
<td>5.27</td>
<td>5.31</td>
</tr>
<tr>
<td>1966</td>
<td>6.09</td>
<td>10.37</td>
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<td>6.26</td>
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<td>5.58</td>
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<td>6.06</td>
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<td>4.61</td>
</tr>
<tr>
<td>1973</td>
<td>5.18</td>
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</tr>
<tr>
<td>1974</td>
<td>5.29</td>
<td>6.66</td>
</tr>
<tr>
<td>1975</td>
<td>5.29</td>
<td>7.76</td>
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<td>7.52</td>
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<td>12.33</td>
<td>13.00</td>
</tr>
<tr>
<td>1990</td>
<td>13.01</td>
<td>15.49</td>
</tr>
</tbody>
</table>

Note: For definitions of $\#$ and $\#\#\#$ see text.
WPAI = Procurement of wheat.
NIMPW = Net imports of wheat.
NIMPR = Net imports of rice.
RPDS = Public distribution of rice.
WPDS = Public distribution of wheat.
RBAL = Stock balancing item for rice (see Chapter 6).
WBAL = Stock balancing item for wheat (see Chapter 6).

4.5 Imports of Wheat and Rice

India has remained a net importer of foodgrains during the period under consideration. The degree and nature of dependence on imports has, however, been varying from period to period. During 1964-90, India imported, on an average, 2.28 million tonnes of wheat and 0.18 million tonnes of rice every year. During 1964-75 the dependence on imports was much higher at 4.42 million tonnes of wheat and 0.34 million tonnes of rice. During 1976-90, a period of relative self-sufficiency, imports have been more sporadic, occurring in drought years averaging to 0.59 million tonnes of wheat and negligible quantity of rice (Appendices 4.1 and 4.2).

During the 1960s, bulk of food imports were under PL 480, their share being as high as 92.2 per cent in case of wheat and 50.3 per cent in case of rice in the triennium ending 1965. There were no PL 480 imports during 1972-73, 1973-74 and 1974-75. Practically, 1971-72 could be treated as the terminal year of PL 480 imports. Wheat constituted most of the food imports not only under PL 480 but even after India resorted to commercial imports. This is because the world market of rice is thin and residual. Wheat has a well-established and large world market and is more easily available than rice.
Imports have always remained a government monopoly believed to be determined in an ad hoc manner by considerations other than economic rationality. Ahluwalia (1977: 28) in her macro-econometric model considers imports as exogenous, 'responding partly to the desire to keep food prices low but governed also by complex politico-economic policy considerations.' Several others, such as NCAER (1991), also treat food imports as exogenous.

Mann (1967) endogenises imports but estimates the import function only for commercial imports (i.e. excluding PL 480 imports). The independent variables chosen by him are per capita quantity supplied, withdrawal from stocks (which bears a wrong sign!) and imports under PL 480. In Rogers et al (1972), cereal import function is estimated like a normal demand function with per capita income, wholesale price of cereals and wholesale price of non-cereals all suitably deflated. Income variable bears a negative sign which is against demand theory. Pani (1977) does not distinguish between PL 480 and other imports and explains total imports of foodgrains in terms of import price of foodgrains, domestic price of food articles, net foreign aid deflated by import price of all goods, and output of foodgrains. His results indicate that imports are more responsive to domestic factors. Krishna and Chhibber (1983) explain imports of wheat in terms of import price deflated by unit value index of all imports, food deficit and aid utilised.

India pursues a policy of self-reliance and has resorted to only marginal imports as and when needed. In this situation, economic or commercial considerations lose much of
their importance. In most studies, PL 480 aid appears as an important explanatory variable. But period covered in the present model (1970-89) has been one in which food aid became negligible. Even commercial imports were small and erratic. As such in this study imports are treated as exogenous to the system.

4.6 Food Subsidy

Total food subsidy has two components: consumer subsidy and subsidy on account of carrying cost of buffer stocks. Both have been on the rise. Consumer subsidy, which is the difference between economic cost and average sales realisation, has risen due to both per unit increase in subsidy as well as due to higher distribution through PDS. Since procurement price is fixed by government, the other components in economic cost are procurement and distribution expenses incurred by FCI.

Details of economic cost formation and its relation with other prices are set out in Appendix 4.14 for wheat and

42 Of the total grants received by India from 1947 to 1967-68, nearly 80 per cent was under PL 480. This came down to 66 per cent during 1967-68 to 1971-72 after which there have been no grants under PL 480. Over the years, the ratio of grants to total aid has declined significantly. At present, Indian imports are mostly on commercial terms.

43 Even in models where imports are endogenised, these appear as a water-tight box in the model interacting with nothing else. Thus in the Krishna-Chhibber model imports of wheat are determined by three variables (total food deficit, aid and import price) all of which are exogenous. Imports only determine closing stocks through an identity and do not affect any other variable. Under these conditions, imports could as well be treated as exogenous.

44 Procurement Costs comprise mandi charges, mandi labour, forwarding charges, internal movement, interest charges, storage charges, cost of gunny, establishment charges and purchase tax and Post-Procurement Costs or distribution expenses consist of handling expenses, storage charges, interest, freight, administrative overheads, and transit and storage shortages. The FCI carries a buffer stock on behalf of government. The entire cost of carrying buffer stocks is reimbursed by the government.
Appendix 4.15 for rice. The purchase cost, which equals the procurement price plus procurement incidentals, is nearly 20-30 per cent higher than the cost of naked grain compared to less than 10 per cent in private trade. In case of rice, however, the FCI's expenses are small (about 10 per cent of procurement price) but this is because the FCI directly acquires rice from the millers and most obligatory expenses are incurred at the stage of paddy.

The average sales realisation (on which FCI has no control as the sale price is fixed by government), has not even been covering the purchase cost of wheat in most of the years and that of rice since 1979-80, let alone distribution expenses.

Economic cost of wheat is about 70 per cent higher and that of rice about 30-35 per cent higher than respective procurement prices. The gap has risen over the years. In case of wheat, economic cost is higher than even the wholesale price in all the years. Though in case of rice, economic cost is generally lower than wholesale price (due to direct purchase of rice by FCI), the ratio between the two prices is deteriorating over the years.

45 The incidentals on purchase of grain are largely (about 80 per cent) of obligatory nature and beyond the control of FCI. These include mandi expenses, purchase tax etc. A major reason for rise in procurement incidentals is imposition of statutory levies by different states. These levies include commission of arhatias, auction fee, market fees, rural development cess and sale/purchase tax. All these levies are fixed as percentage to procurement cost and impose a heavy burden on buyers of foodgrains.

46 Based on personal discussion with grain merchants in Delhi and Bombay.

47 Tyagi (1990) makes some adjustments to economic cost by adding to it interest subsidy and state distribution margin and deducting freight costs. He then compares this adjusted economic price with retail prices at
Economic cost has risen on account of rise in procurement and distribution expenses, notably the latter. From a little over Rs 9 per quintal in 1968-69, distribution expenses went up to over Rs 76 in 1989-90. In real terms as well, these expenses have risen at an alarming rate as would be seen in Appendix 4.16. Indices of distribution expenses and total expenses have risen at a rate much higher than (i) general price index, (ii) procurement price index (rice or wheat), and (iii) index of total quantity of rice and wheat procured by FCI.

Due to rising expenses of FCI on the one hand and rising quantity of distribution of foodgrains on the other, total food subsidy has risen from Rs 47 crore in 1971-72 to Rs 1,941 in 1989-90. The subsidy in 1993-94 is likely to soar to Rs 6,000 crore. As percentage to procurement price, subsidy on rice (per unit) increased from 19.84 per cent in 1980-81 to 40.63 per cent in 1989-90. In wheat, the rise was from 34.36 per cent to 58.42 per cent over the same period.

But food subsidy has risen more on account of rise in the subsidy rate rather than due to increased distribution. The subsidy rate has gone up partly because of non-adjustment of issue prices, but equally importantly due to inefficient and costly nature of FCI operations. Between 1980-81 and 1989-90, different centres and finds economic price to be much higher than even the retail prices. Put differently, the price at which FCI can place rice and wheat in the market without any loss is much higher than the price at which consumers can get their supplies from open market.

48 The subsidy figures as given in budget documents often differ from those reported by FCI. The main difference occurs because the expenses on account of shortages are not reimbursed by the government in the year these are incurred. A standing committee goes into the reasons for shortages and has to certify that these were unavoidable before the government pays the bill.
distribution of rice increased by 35 per cent and wheat by 2 per cent but subsidy rate over the same period went up by 265 per cent and 166 per cent respectively.

Inefficient functioning of FCI raises food subsidy and is a fiscal burden. Alongwith fertiliser subsidies, this has had the crowding out effect on productive capital investment in agriculture (both public and private). This is particularly indefensible since the whole of food subsidy does not constitute benefit to consumers and is largely incurred to finance FCI's uneconomic and inefficient functioning. This widens the gap between 'subsidy' and 'benefit'. This gap can be bridged by bringing about greater efficiency in management of food economy and by better targeting.

In the present model, food subsidy is used in the following identity

\[
\text{GOISUB} = \left( (\text{WPP} + \text{WEXPS} - \text{ISSPW}) \times \text{WOFT} \right) + \left( (\text{RPP} + \text{REXPS} - \text{ISSPR}) \times \text{ROFT} \right) \tag{17}
\]

where,

- \( \text{GOISUB} \) = Subsidy on offtake of rice and wheat from fair price shops (Rs crore).
- \( \text{WPP} \) = Procurement price of wheat (Rs/quintal).
- \( \text{RPP} \) = Procurement price of rice (Rs/quintal).
- \( \text{ISSPW} \) = Issue price of wheat (Rs/quintal).
- \( \text{ISSPR} \) = Issue price of rice (Rs/quintal).
- \( \text{WEXPS} \) = Procurement and distribution expenses on wheat (Rs/qt).
- \( \text{REXPS} \) = Procurement and distribution expenses on rice (Rs/qt).
- \( \text{WOFT} \) = Offtake of wheat from fair price shops (Mn tonnes).
- \( \text{ROFT} \) = Offtake of rice from fair price shops (Mn tonnes).
4.7 Summary

The major instruments of government intervention in food sector are procurement, distribution, imports and storage. Procurement of rice and wheat is significantly determined by output, procurement prices and open market prices. Administrative measures have not been found to be significant in determining the quantum of procurement. Offtake from PDS is explained in terms of private final consumption expenditure, ratio of issue prices to market prices, a dummy variable for drought years and lagged dependent variable. Actual level of public stocks have deviated significantly from the desired stocks which questions the 'scientific' principles on which buffer stock policy is supposed to be based. Therefore, stocks are treated as residually determined in the model through an identity. Imports are treated as exogenous and determine, along with other variables, closing stocks in the identity.