

**THE PFDS  
AND  
FOODGRAIN STOCKS:**

**COSTS, BENEFITS  
AND POLICY OPTIONS**

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## EXECUTIVE SUMMARY

Since the late 1990s, there has been a gradual shift in Government of Bangladesh policy in favor of increased public foodgrain stocks. In the mid-1990s, the operational stock target of the Public Foodgrain Distribution System (PFDS) was effectively in the range of 700 to 800 thousand metric tons. However, sharp declines in food stocks in early 1998 following an unexpectedly poor aman harvest in November/December 1997 and shortages of wheat stocks after the floods in July through September 1998 have led many to conclude that higher levels of stocks were needed. Currently, the official government stock target is 1.0 million metric tons, as announced by the Honorable Prime Minister in 1998.

The determination of appropriate stocks levels involves several aspects. Working stocks are needed for smooth operation of the PFDS. Emergency foodgrain reserves, not necessarily in addition to working stocks, are also needed to alleviate the effects of possible relief and market stabilization needs in the event of major disasters (floods, cyclones) and crop shortages. Holding stocks involves real financial costs, however, including those involved in storage losses, and construction and maintenance of storage facilities, as well as the costs involved in rotating stocks through the PFDS. The costs of stock deterioration, borne by recipients of PFDS foodgrain, are generally not included in financial analyses of the costs of holding stock, though.

Earlier empirical modeling exercises have focused on analysis of stocks and their implications for price stabilization (Goletti, Ahmed and Chowdhury, 1991; Brennan, 1995; Goletti and Rich 1998). These analyses have highlighted several major lessons, including the importance of clarifying objectives (price stabilization, working stocks for the PFDS), and that lowest costs can be achieved through using rice for rice price stabilization and wheat for foodgrain distribution to the poor. These analyses have also emphasized that "optimal stock" should not be thought of as a single number, but as a path of stock levels over time that depend on policy regime and policy objectives. In

particular, significant savings can be achieved through reliance on international trade (importing in times of shortage and exporting in times of surplus) to supplement moderate levels of stocks. As shown in Dorosh and Shahabuddin (1999), private sector imports of rice following the 1998 floods helped stabilize rice prices at no cost to the public exchequer, keeping domestic prices from rising above import parity levels.

### PFDS STOCK POLICY AND HISTORICAL STOCK LEVELS

PFDS stock policy and stock levels have changed over time along with the overall size of the PFDS and the major distribution channels. During the 1990s, there were three episodes when stock levels were precariously low, at approximately 205 thousand MTs or less of rice or wheat: September 1994 through April 1995, due to a poor harvest and difficulties with rice imports; December 1997 through April 1998, due to a poor aman harvest; and August through October 1998, during the 1998 floods. There were three episodes of high stocks during this period, as well, when quality deterioration of foodgrain in storage became a serious problem: July 1996 through June 1997; 1999/2000; and the first eight months of 2000/2001. These latter two episodes followed the 1998 floods and were linked to very high levels of domestic procurement.

The experiences of the 1998 flood and other periods of production shortfalls suggest the importance of minimum stock targets. Because of seasonal fluctuations in distribution and in domestic procurement, however, requirements for both emergency and working stocks fluctuate throughout the year. There are four key points during the year at which minimum end-stock levels are important: July (for possible emergency distribution in the event of a major flood), November (because of the possible failure of aman procurement), January (for rice market stabilization in the event of a poor aman harvest) and March (just before boro and wheat harvests and procurement, which are far less uncertain than aman harvests and procurement). Suggested stock targets range from 700 thousand MTs for end-March to 850 thousand MTs for end-January. These suggested

seasonal stock targets have in fact generally been maintained throughout the 1989 through 2001 period, except for the crisis periods discussed above.

#### FINANCIAL AND ECONOMIC COSTS AND BENEFITS OF PFDS OPERATIONS

The GOB financial accounts for the PFDS show outlays and receipts from the standpoint of the Ministry of Food. Outlays include domestic and international commercial procurement, as well as operational costs. Food aid is also shown as an expenditure of the Ministry of Food in the government accounts, being purchased from the “foreign aid” account. Receipts include transfer payments for foodgrain received from other GOB ministries (such as the Ministry of Disaster Management and Relief and the Ministry of Education).

The value of foodgrain “purchased” by other ministries for their programs involving food distribution is calculated using the “economic price” of the foodgrain. This price represents the full financial cost of the foodgrain supplied, calculated using the average procurement price during the year, plus handling and administrative costs. This book value, “economic price” does not necessarily have any relation to the market price of foodgrain at the time of the distribution, however.

Since the expenditures of other Ministries for foodgrain are considered as part of development or relief expenditures and are valued using the economic price, there is technically no subsidy involved. Thus, the official GOB food subsidy is calculated only for distribution through sales channels (such as Open Market Sales, Essential Priorities, etc.), and is equal to the difference between the sales price and the economic price multiplied by the quantity of grain sold in each channel. For 2000/01, the estimated food subsidy (for rice and wheat distribution only) was 258 crore Taka. Intra-governmental transfers, (the book costs of non-sales channel distribution apart from Food For Work), were equal to 1244 crore Taka, more than 4.82 times as large as the official food subsidy on rice and wheat.

Estimating the actual value of the PFDS to producers and consumers requires an accounting system based on market prices, not on financial prices, of the GOB. Market prices change throughout the year, however, affecting the value of procurement and distribution, as well as the value of stocks. Valuing stocks, procurement and distribution and market prices each month permits an analysis of the direct costs and benefits (apart from the effects on price stabilization) of the PFDS.

For example, in 2000/01, 823 thousand MTs of rice were procured domestically at a total cost of 1219 crore Taka. The average cost of domestically procured rice is thus 14.81 Tk per kg (Tk.12.86/kg fixed procurement price plus Tk1.95/kg for marketing, management etc.). Given an average market value of rice of 11.17 Tk/kg (Tk 9.71/kg producers' price plus Tk 1.46/kg for marketing, management etc.) during the procurement months, the market value of the procured quantity was 919 crore Taka. Thus, the subsidy on domestic rice procurement was 300 crore Taka (about 55 million dollars).

The value of foodgrain to consumers is calculated using the market price in the month in which the foodgrain is distributed. Moreover, rice in excess of 7 months old and wheat in excess of 8 months old is assumed to have a market value equal to only 85 percent of the market price of new foodgrain.

Using this framework, the total net outlay of the PFDS can be decomposed to show benefits and losses. The consumer subsidy, calculated as the difference between the market price of food and the sales price to consumers multiplied by the quantity distributed, is the largest component of the PFDS, accounting for 57.4 percent of net outlay in 2000/01. The producer subsidy (314 crore Taka, of which 259 crore Taka was for domestic rice producers), accounts for 20.9 percent of total net outlays. Changes in the value of stock due to price effects and quality adjustments represent 11.7 percent of net outlays. The remaining 10.0 percent of net outlays is due to excess valuation of food aid and higher marketing costs of the PFDS in comparison with the private sector.

Implicit losses to rice consumers of quality deterioration were significant in 2000/01: about 105 crore Taka (about 19 million dollars), equal to 10.9 percent of total net outlay on rice of the PFDS. Avoiding quality losses requires either increased shelf life or quicker stock rotation (through distribution or some form of open market sales).

#### ANALYSIS OF ALTERNATIVE PFDS STOCK OPTIONS

The framework outlined in the previous section can facilitate an analysis of the benefits and costs of alternative stock policies. Because quality of foodgrain is an important aspect of policy and the GOB currently has no mechanism to rotate stocks apart from PFDS distribution, the level of stocks is closely related to the size of the PFDS. Thus, in this section, we analyze various combinations of stock and distribution levels, estimating financial costs to the government and overall benefits to producers and consumers, (ignoring the possible effects on market price stabilization).

The base scenario is designed to approximate the size of the PFDS in 2000/01, with starting and ending net stocks of rice and wheat (available at the points of distribution) each equal to 400 thousand MTs, and with total distribution of 1.8 million MTs, (850 thousand MTs of rice and 950 thousand MTs of wheat). Month-by-month procurement and distribution in the base scenario reflect typical timing and levels of actual procurement and distribution occurred in FY 2000/2001. Table 4.1 shows, with near-ideal stock management, only 58 thousand MTs of rice more than 7 months old is distributed in the base scenario. No wheat more than 8 months old is distributed.

If stock is increased to 1.0 million MTs, but distribution is unchanged under Option 1, the amount of old stock distributed increases to 336 thousand MTs of rice and 170 thousand MTs of wheat, though net outlay is essentially unaffected. Thus, quality loss as a percentage of net outlay rises from 0.9 percent in the base to 6.5 percent in Option 1.

In order to avoid the problems of accumulation of old stock, distribution could be increased along with the target stock levels under Option 2. In this scenario, however,

there is a large increase in net outlay of 163 crore Taka, as increased distribution is assumed to take place through non-sales channels. The marginal benefit to consumers (and producers) is rather small, however, (only 52 crore Taka) and the marginal benefit/cost ratio is only 0.32.

Reducing stock to 0.7 million MTs and keeping distribution at 1.8 million MTs (the level of distribution in the base scenario) under Option 3, has very little effect on marginal outlay, but results in a minimum rice and total net stock level of only 202 thousand MTs and 625 thousand MTs respectively, at its lowest point during the year.

Finally, under Option 4, distribution of rice is increased by 50 thousand MTs relative to the base, and wheat stocks are increased by 50 thousand MTs while rice stocks are reduced by 50 thousand MTs. As a result of these changes, quality loss in the system is greatly reduced because no rice stock reaches 7 months of age. The marginal net outlay of 62 crore Taka produces 82 crore Taka of benefits and the marginal benefit/cost ratio is 1.33.

Thus, costs and benefits of alternative stock targets are closely related to storage losses and the levels of distribution required to rotate stocks. Increasing the size of stock by moderate amounts, (e.g. 200 thousand MTs in Option 1), leads to only small net marginal outlays, but unless procurement and distribution are also raised, the quality of the stock for distribution deteriorates.

### CONCLUSIONS AND POLICY IMPLICATIONS

Foodgrain stocks serve dual purposes: they provide working stocks for routine distribution and they also serve as security stocks for emergency distribution. However, increases in stock levels imply either increased distribution or quality losses. The direct costs of increased distribution are clearly shown in the government accounts. The costs to consumers of quality deterioration of PFDS foodgrain are not accounted for, however. Closer attention to the quality of foodgrain in storage, and the tight link between size of stocks and the amount of distribution needed to rotate stocks is needed. Thus, decisions

on procurement need to be taken in light of the potential costs of increased distribution and quality deterioration of stocks. The accounting framework provided in this report can enhance this analysis by quantifying (even if only roughly) the hidden costs of quality losses for consumers.

Further analysis of these issues might include taking into account the effects of distribution and procurement on market prices. Other analysis might also be done on the costs of alternative minimum stocks for emergency distribution needs, (which were implicitly included in the analysis shown in the preceding sections through attention given to the minimum stock at any point of the year).

Finally, the analysis shows that current stock levels are broadly consistent with the current level of PFDS distribution, given available stock rotation options. Holding higher stocks and keeping distribution constant would entail substantial quality losses, unless alternative means of rotating stocks (e.g. through sales and purchases at open market prices at the wholesale levels) are adopted. Holding lower stocks would result in minimum stock levels falling below currently perceived "safe" levels for emergency distribution needs. Small changes in the stock levels, however, have relatively small effects on the costs and benefits of the PFDS. Maintaining good quality storage, effective stock management and minimizing leakage are more important determinants of the overall PFDS financial efficiency.

## 1. INTRODUCTION

Since the late 1990s, there has been a gradual shift in Government of Bangladesh policy in favor of increased public foodgrain stocks. In the mid-1990s, the operational stock target of the Public Foodgrain Distribution System (PFDS) was effectively in the range of 700 to 800 thousand metric tons. However, sharp declines in food stocks in early 1998 following an unexpectedly poor aman harvest in November/December 1997 and shortages of wheat stocks after the floods in July through September 1998 have led many to conclude that higher levels of stocks were needed. Currently, the official government stock target is 1.0 million metric tons, as announced by the Honorable Prime Minister in 1998, though the mid-term evaluation of the five-year plan included a statement that the target level would be 1.2 million metric tons.

The determination of appropriate stocks levels involves several aspects. Working stocks are needed for smooth operation of the PFDS, which distributed 1.9 million metric tons of foodgrain in FY 1999/2000 and 1.77 million metric tons of foodgrain in 2000/01. Emergency foodgrain reserves, not necessarily in addition to working stocks, are also needed to alleviate the effects of possible relief and market stabilization needs in the event of major disasters (floods, cyclones) and crop shortages. Holding stocks involves real financial costs, however, including those involved in storage losses, and construction and maintenance of storage facilities, as well as the costs involved in rotating stocks through the PFDS. The costs of stock deterioration, borne by recipients of PFDS foodgrain, are generally not included in financial analyses of the costs of holding stock, though.

Earlier empirical modeling exercises have focused on analysis of stocks and their implications for price stabilization (Goletti, Ahmed and Chowdhury, 1991; Brennan, 1995; Goletti and Rich 1998). These analyses have highlighted several major lessons,

including the importance of clarifying objectives (price stabilization, working stocks for the PFDS), and that lowest costs can be achieved through using rice for rice price stabilization and wheat for foodgrain distribution to the poor. These analyses have also emphasized that “optimal stock” should not be thought of as a single number, but as a path of stock levels over time that depend on policy regime and policy objectives. In particular, significant savings can be achieved through reliance on international trade (importing in times of shortage and exporting in times of surplus) to supplement moderate levels of stocks. As shown in Dorosh and Shahabuddin (1999), private sector imports of rice following the 1998 floods helped stabilize rice prices at no cost to the public exchequer, keeping domestic prices from rising above import parity levels.

This paper extends the earlier analyses of stocks, focusing on the economic costs of stock deterioration in storage, including the implicit costs to recipients of PFDS foodgrain. Section 2 presents a brief review of government policy and actual levels of stocks consumers. In Section 3, we outline an accounting framework that includes the value of grain to recipients of the PFDS, and give estimates of the costs and benefits of the PFDS in recent years. Section 4 analyzes alternative options for stocks and the cost of the PFDS in terms of costs and benefits to consumers and producers. The last section contains policy implications and conclusions.

## 2. PFDS STOCK POLICY AND HISTORICAL STOCK LEVELS

PFDS stock policy and stock levels have changed over time along with the overall size of the PFDS and the major distribution channels (Figures 2.1, 2.2). In the late 1980s and early 1990s, PFDS total annual distribution ranged from 2.16 to 2.97 million MTs, with much of the foodgrain distributed through ration channels, involving subsidized sales of foodgrain to ration cardholders. PFDS gross stock levels in 1989/90 and 1990/91 averaged 1.13 million MTs,<sup>1</sup> equal to 6.02 times monthly average distribution in these years (Table 2.1).

Major reforms in the PFDS took place in the early 1990s with the elimination of major rationing channels (Statutory Rationing and Rural Rationing) and greater emphasis on targeted distribution. Total distribution was reduced to an average of only 1.53 million MTs from 1993/94 through 1996/97. Stock levels were reduced as well, with average annual stocks ranging from 577 to 950 thousand MTs over this period.

Total public foodgrain stocks since the 1998 floods, however, have increased substantially to an annual average of 1.35 million MTs in FY 1999/2000 and 1.05 million MTs in 2000/01. This very large PFDS stock build-up occurred mainly because of delayed import arrivals and relatively high levels of domestic procurement in response to falling market prices immediately after the harvest of consecutive bumper crops in boro (1999), aman (1999/2000), boro (2000), aman (2000/01) and latest boro (2001). About 604 thousand metric tons of rice was procured from the bumper boro harvest in 1999, and this, along with delayed arrivals of food aid for flood rehabilitation led to a sharp increase

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<sup>1</sup> Unless otherwise noted, all foodgrain stocks figures in this report indicate net stocks, i.e. gross stocks less a deduction for foodgrain in transit. In 2000/2001, 15 thousand MTs of rice and 88 thousand MTs of wheat were considered to be "in transit".

**Table 2.1 — Annual PFDS Distribution and Gross Foodgrain Stock**

Year	Average monthly stock (000 MT)			Avg monthly off-take (000 MT)			Monthly average stock to Monthly average off-take		
	Rice	Wheat	Total	Rice	Wheat	Total	Rice	Wheat	Total
1989/90	660	541	1201	56	124	180	11.73	4.36	6.66
1990/91	549	513	1062	81	117	198	6.78	4.40	5.38
1991/92	491	324	815	63	132	195	7.76	2.45	4.17
1992/93	594	592	1186	40	50	89	15.01	11.88	13.27
1993/94	258	475	733	29	86	115	8.85	5.55	6.39
1994/95	177	400	577	27	104	131	6.46	3.86	4.40
1995/96	401	488	889	49	100	150	8.13	4.88	5.95
1996/97	551	398	949	62	54	116	8.95	7.31	8.18
1997/98	297	455	752	44	91	135	6.74	5.00	5.57
1998/99	424	562	986	44	134	178	9.60	4.20	5.54
1999/00	666	682	1348	73	85	158	9.12	7.99	8.51
2000/01	643	406	1049	82	65	147	7.84	6.26	7.14

Source: MIS, Director General of Food and authors' calculation

Table 2.2 — Periods of Low and High Stocks in the 1990s

Periods	Average monthly stock (000 MTs)			Avg. monthly distribution (000 MTs)			Stock to distribution (000 MTs)		
	Rice	Wheat	Total	Rice	Wheat	Total	Rice	Wheat	Total
<b>Low stock periods</b>									
1994/95 (Sep-Apr)	130	370	500	33	113	145	3.98	3.29	3.44
1997/98 (Dec-Apr)	205	313	518	58	135	193	3.55	2.31	2.68
1998/99 (Aug-Oct)	400	162	562	55	46	101	7.23	3.54	5.56
<b>High stock periods</b>									
1996/97 (Jul-Jun)	554	309	863	53	84	136	10.54	3.70	6.34
1999/00 (Jul-Jun)	662	602	1263	73	85	158	9.07	7.05	7.98
2000/01 (Jul-Apr)	682	310	993	68	127	194	10.05	2.45	5.11

in stocks. Stocks peaked at 1.63 million metric tons in December 1999 (654 thousand metric tons of rice and 976 thousand metric tons of wheat).<sup>2</sup>

#### PERIODS OF EXCESSIVELY LOW STOCKS

During the 1990s, there were three episodes when stock levels were precariously low, at approximately 205 thousand MTs or less of rice or wheat (Table 2.2). The first episode occurred from September 1994 through April 1995, when aman procurement failed because drought severely damaged the 1994/95 aman crop, and government commercial imports were delayed by up to 15 months because of failure of suppliers to deliver according to contract schedules.

<sup>2</sup> Subsequently, careful management of the PFDS, including cancellation of commercial wheat imports, reductions of wheat distribution and increases in rice distribution reduced the stock level and essentially cleared all the old stock by April 2001.

A second period of low stocks, from December 1997 through April 1998, followed an unexpectedly poor aman harvest in November/ December 1997. In that year, a short drought during the critical flowering stage of the rice plants resulted in widespread prevalence of empty husks (*chita*), and about 7.35 percent reduction in the aman harvest. Prices rapidly rose above the fixed procurement price, so that regular procurement failed. Difficulties with contracts for government commercial imports limited international procurement as well, and rice stocks fell to only 137 thousand MTs in March 1998.<sup>3</sup>

Stocks were also uncomfortably low from August through October 1998, when widespread floods destroyed aman rice seedlings, ultimately reducing the November/ December 1998 harvest. In response to the appeals for aid in late August 1998, donors pledged 1.083 million MTs of foodgrain for flood relief, but major food aid arrivals were not expected until November.

Thus, with only 231 thousand MTs of wheat stocks, expansion of distribution through the Vulnerable Group Feeding (VGF) was limited to 64 thousand MTs per month (half rice and half wheat) instead of the 141 thousand MTs of wheat per month proposed by the World Food Programme (WFP).<sup>4</sup>

#### PERIODS EXCESSIVELY HIGH STOCKS

Though the situation often appears less urgent than for low stock periods, high stock periods can be problematic as well, because of quality deterioration of foodgrain in storage. Although it is technically possible to store rice and wheat for periods exceeding one year, significant deterioration in rice quality (especially discoloration) often occurs in rice store for more than six months in PFDS godowns. Wheat storage problems are less, particularly in government silos, though in recent years there have been serious quality problems with imported wheat stored more than six months as well.

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<sup>3</sup> Shortly thereafter, in April 1998, the Prime Minister announced an official stock target of 1.0 million metric tons.

<sup>4</sup> Subsequent food aid arrivals enabled a large expansion in Food For Work in early 1999, however. See Dorosh (1999).

There have been three periods of excessively high stocks since the mid-1990s (Table 2.2). The first period, from July 1996 through June 1997, average rice stocks were 554 thousand MTs, while average monthly rice distribution was only 53 thousand MTs. Thus, rice stocks were on average equal to 10.54 months of rice distribution. This situation occurred because of the delayed delivery of 491 thousand MTs of rice tendered by the government in 1994/95 that did not arrive until 1995/96.

The other two periods of high stocks followed the 1998 floods. Average monthly rice stocks exceeded 600 thousand MTs in both 1999/2000 and the first eight months of 2000/2001, equal to 9.07 and 10.05 months of distribution, respectively. Wheat stocks were also high in 1999/2000, on average equal to 7.0 months of distribution, and some imported wheat (apparently already old when it arrived in Bangladesh) severely deteriorated in quality. Fiscal year closing PFDS gross stock for 1999/2000 (30<sup>th</sup> June, 2000) was 1.091 million MTs. While currently, the end-June 2001 gross PFDS stocks stood at 865 thousand metric tons (420 thousand metric tons of rice and 445 thousand metric tons of wheat).

These problems of stock deterioration during periods of high stocks can be overcome through increases in public distribution. As is shown in sections 3 and 4, public distribution of foodgrains typically involves large subsidies. An alternative approach, open market sales at a wholesale level through public auction (and possibly simultaneous domestic procurement through competitive tender) would enable the Government of Bangladesh to rotate stocks at significantly less fiscal costs.

#### SEASONAL NET PFDS STOCK TARGETS

The experiences of the 1998 flood and other periods of production shortfalls suggest the importance of minimum stock targets. Because of seasonal fluctuations in distribution and in domestic procurement, however, requirements for both emergency and working stocks fluctuate throughout the year. There are four key points during the year at

**Table 2.3 — Seasonal Net PFDS Stock Targets**

	(000 metric tons)		
	Rice	Wheat	Total
<b>July</b>	400	300	830
<b>November</b>	300	300	800
<b>January</b>	400	350	850
<b>March</b>	300	350	700

Source: Authors' calculations.

Note: \* Stock targets assume annual PFDS distribution of approximately 850 thousand MTs rice and 950 thousand MTs wheat, with distribution channels similar to actual distribution in 2000/01.

which minimum end-stock levels are important: July, November, January and March (Table 2.3).

Sufficient stocks for possibly emergency distribution in the event of a major flood are needed at the end of July. At least 830 thousand MTs of foodgrain are needed to allow for up to 600 thousand MTs of emergency relief distribution from August through November. Given that large amounts of boro rice are generally procured to support producer prices from May through July, at least 400 thousand MTs of the total 830 thousand MTs should be rice. A minimum of 300 thousand MTs of wheat is proposed for emergency needs and normal program distribution. Generally, emergency food aid, if needed, can be expected to supplement government stocks by December.

End-November stock targets are also important because of the possible failure of aman procurement, as in November/December 1997 when there was a serious aman shortfall caused by a short hidden drought that resulted in widespread prevalence of unfilled grains (chita). Even lesser shortfalls have caused aman procurement to fail as domestic prices rose above procurement price levels (Shahabuddin and Dorosh, 1999).

Given possible needs for rice market stabilization in the event of poor aman harvest, the suggested end-January stock target is 400 thousand MTs. In the event of a failed domestic aman fixed-price procurement, the GOB could procure rice domestically through open tenders, initiate GOB imports of rice through commercial channels, and encourage private sector imports (Dorosh, 1999; Shahabuddin and Dorosh, 1999).

Government procurement through fixed-price domestic procurement, commercial imports, food aid and domestic tenders should be sufficient to achieve a minimum level of at least 700 thousand MTs of stock at the end of March, (at least 300 thousand MTs of rice and 350 thousand MTs of wheat). Stock targets are lowest for end-March since boro and wheat harvests and procurement (which are far less uncertain than aman harvests and procurement) begin in April.

As shown in Figures 2.1, 2.2 and 2.3, these suggested seasonal stock targets have generally been maintained throughout the 1989 through 2001 period, except for the crisis periods discussed above.

Figure 2.1 — Net Closing Stocks of Rice in Bangladesh, 1990-2001

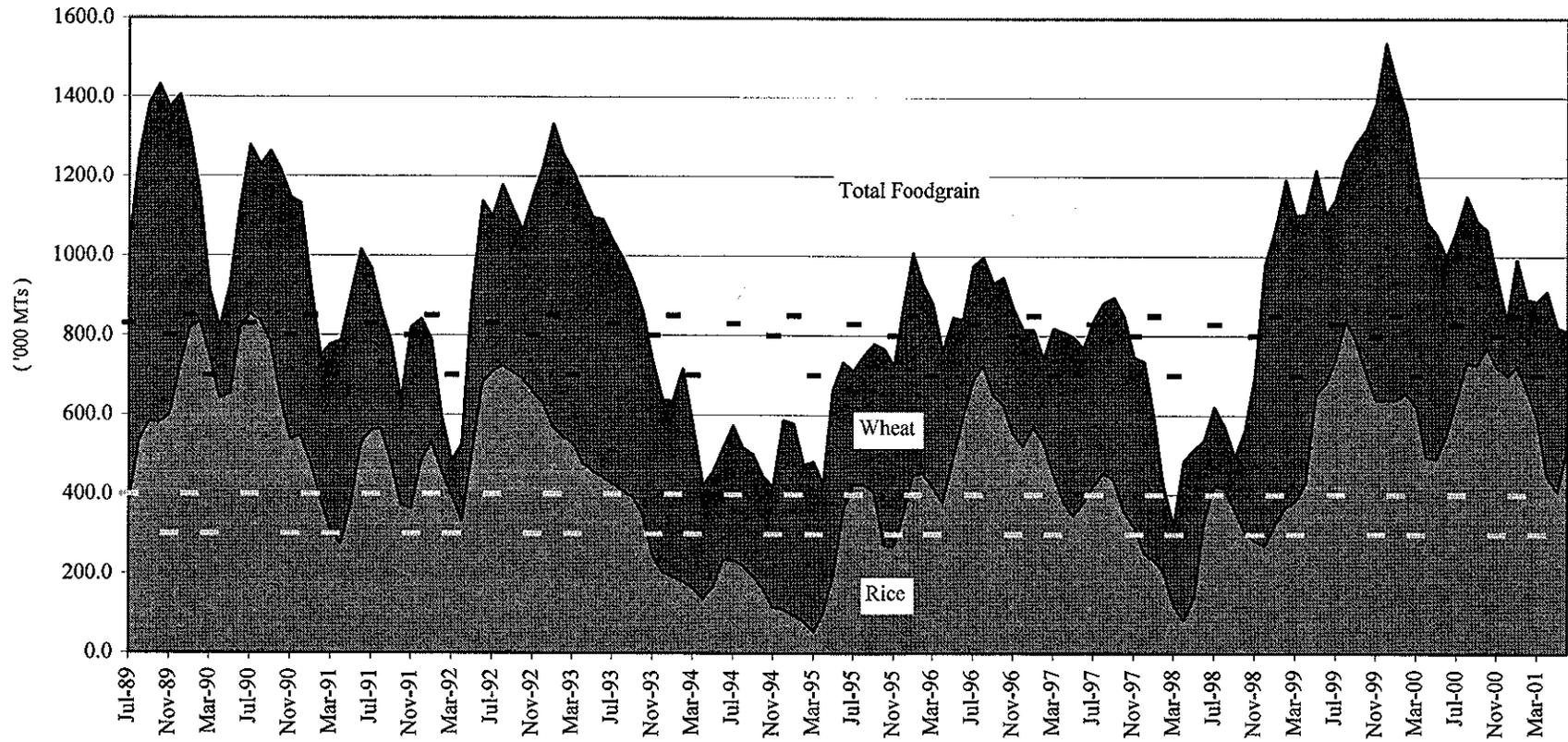


Figure 2.2 — Net Closing Stocks of Wheat in Bangladesh, 1990-2001

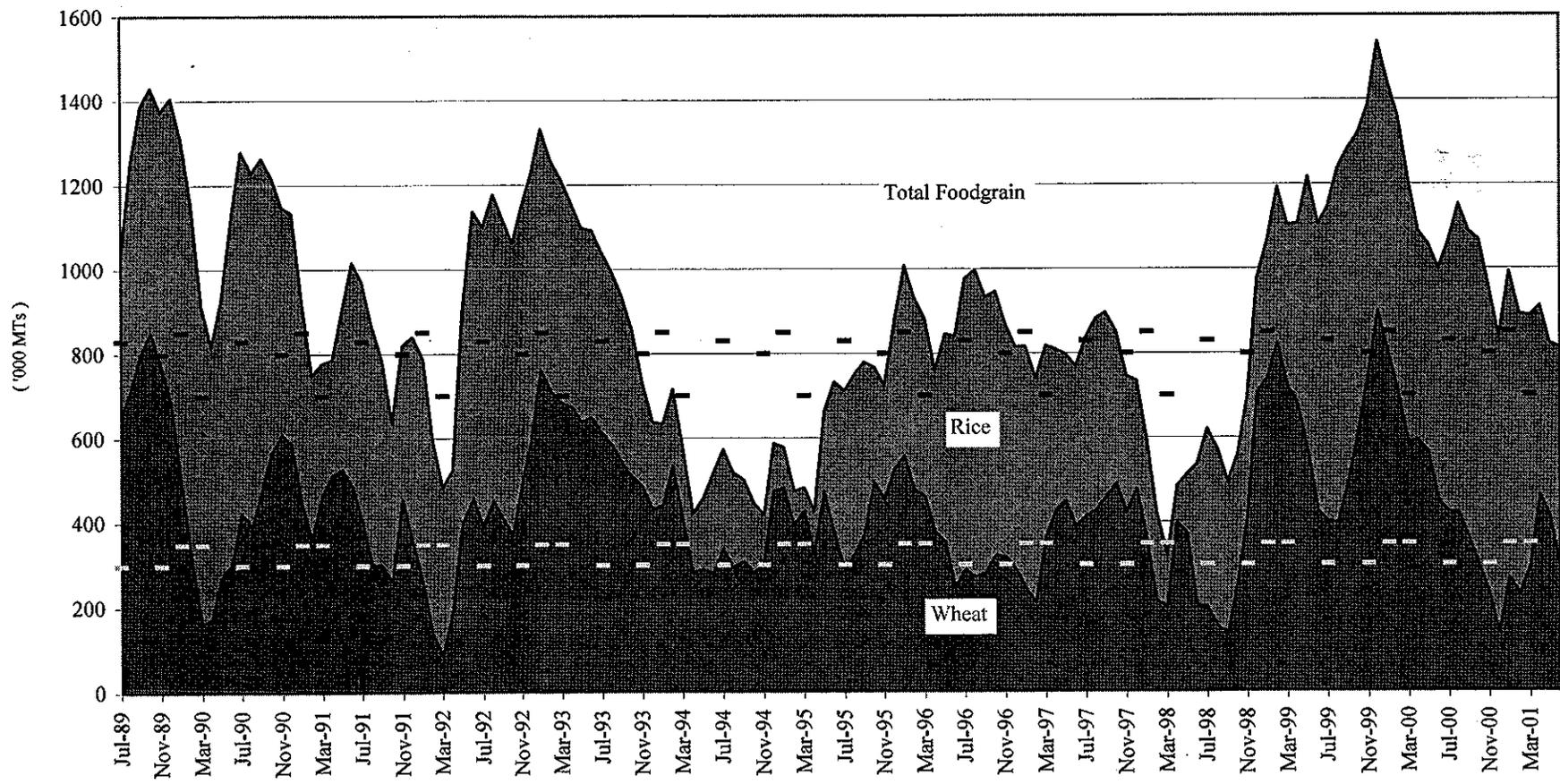
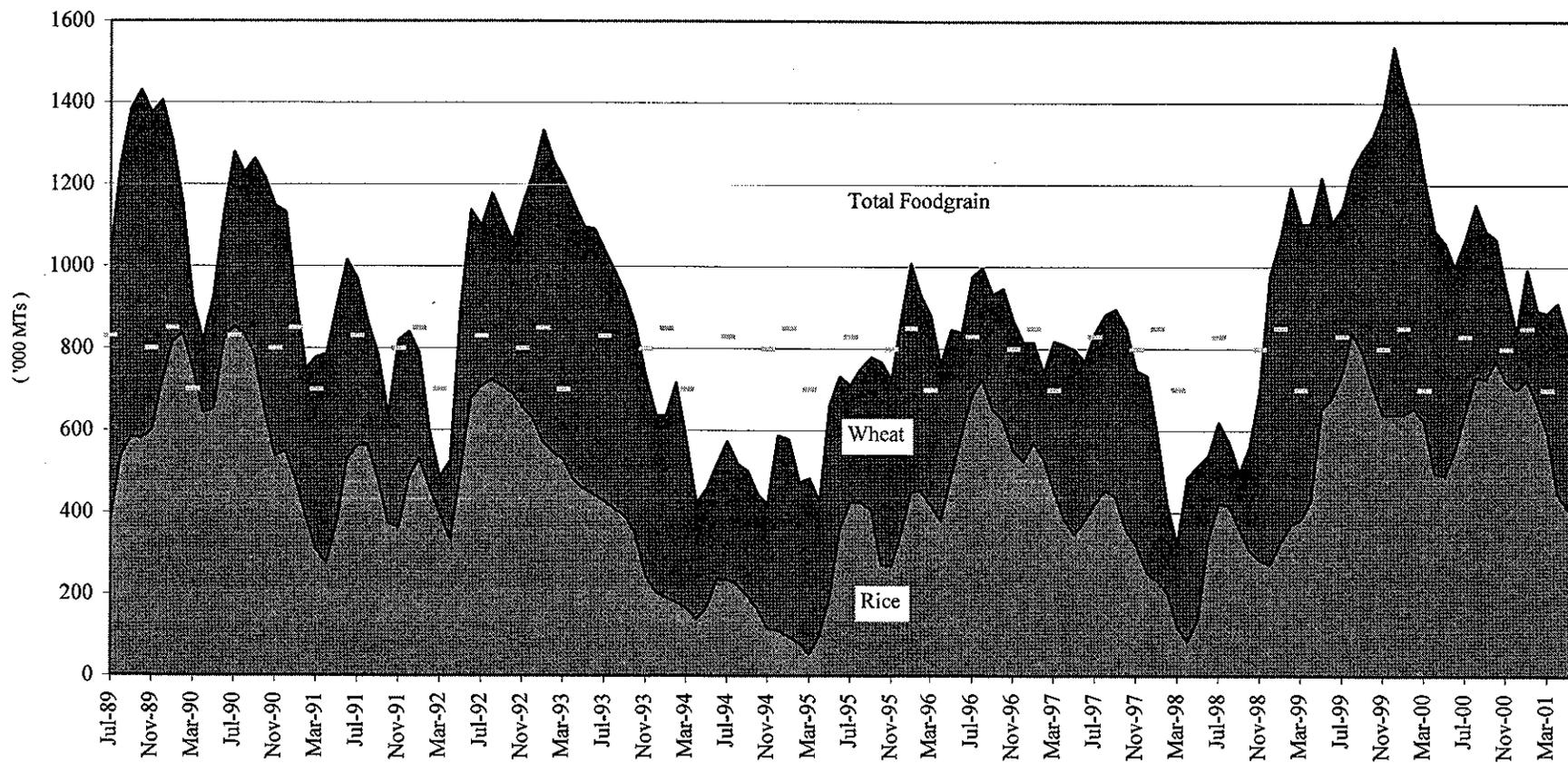


Figure 2.3 — Net Closing Stocks of Total Foodgrain in Bangladesh, 1990-2001



### **3. FINANCIAL AND ECONOMIC COSTS AND BENEFITS OF PFDS OPERATION**

Government of Bangladesh financial accounts of the PFDS record the receipts and outlays of the Ministry of Food. These accounts, however, record only financial flows at "book values" of the commodities and do not include adjustments for changes in prices due to changes in market conditions or due to changes in stock quality. To assess the costs and the size and distribution of the benefits of the PFDS requires an accounting system that values grain at market prices.

#### **GOB FINANCIAL ACCOUNTS FOR THE PFDS**

The GOB financial accounts for the PFDS show outlays and receipts from the standpoint of the Ministry of Food (Table 3.1). Outlays include domestic and international commercial procurement, as well as operational costs. Food aid is also shown as an expenditure of the Ministry of Food in the government accounts, being purchased from the "foreign aid" account. Receipts include transfer payments for foodgrain received from other GOB ministries (such as the Ministry of Disaster Management and Relief and the Ministry of Education).

The value of foodgrain "purchased" by other ministries for their programs involving food distribution is calculated using the "economic price" of the foodgrain. This price represents the full financial cost of the foodgrain supplied, calculated using the average procurement price during the year, plus handling and administrative costs. This book value, "economic price" does not necessarily have any relation to the market price of foodgrain at the time of the distribution, however.

Since the expenditures of other Ministries for foodgrain are considered as part of development or relief expenditures and are valued using the economic price, there is technically no subsidy involved. Thus, the official GOB food subsidy is calculated only

**Table 3.1 — PFDS Financial Costs, Actual 2000/01 (crore taka)**

	<b>Rice</b>	<b>Wheat</b>	<b>Total</b>
<b>OUTLAY</b>			
Domestic Procurement	1058	236	1294
Food Aid	46	441	486
Commercial Imports	0	0	0
Marketing and Establishment Costs	171	151	322
<b>Total Outlay</b>	<b>1275</b>	<b>828</b>	<b>2103</b>
<b>RECEIPTS</b>			
Ration Channels	38	57	96
Food For Work	469	304	773
Change in Value of Stock	-192	-76	-268
<b>Total Net Outlay</b>	<b>959</b>	<b>543</b>	<b>1502</b>
Subsidy on Sales Channels	153	105	258
Intra-GOB Transfers (Non-Sales, Non-FFW)	806	438	1244

**Table 3.2 — PFDS Subsidies on Rice, Actual 2000/01, (FY 2000/2001 Prices)**

	PFDS			Market Value Total			Market Value Q1			Market Value Q2			Subsidy
	Quantity (000 MT)	Price (Tk/Kg)	Value (crore Tk)	Transfer (crore Tk)									
<b>Sources of Foodgrain</b>													
Opening Stock (at previous year's end price)	563	14.75	831	563	12.21	688	563	12.21	688	0	10.41	0	143
Opening Stock (at current year's end price)	563	14.91	840	563	11.38	641	563	11.38	641	0	9.93	0	199
Change in Value of Opening Stock			9			-47			-47			0	56
Domestic Rice Procurement	823	12.86	1058	823	9.71	799	823	9.71	799				259
Marketing, Management Cost (Domestic)	823	1.32	109	823	1.46	120	823	1.46	120				-11
Food Aid Rice Imports	32	14.30	46	32	14.30	46	32	14.30	46				0
Marketing, Management Cost (Food Aid)	32	2.47	8	32	2.47	8	32	2.47	8				0
Government Commercial Rice Imports	0	14.30	0	0	14.30	0	0	14.30	0				0
Marketing, Management Cost (Imports)	0	2.47	0	0	2.47	0	0	2.47	0				0
Fixed Costs per Unit of Procurement	855	0.63	54										54
Total Cost of Procurement	855	14.91	1275	855	11.38	973	855	11.38	973				302
<b>Uses of Foodgrain</b>													
Rice Distribution	984	5.16	508	984	10.34	1017	278	11.38	317	706	9.93	700	-509
Sales Channels	129	2.98	38	129	10.34	133	36	11.38	41	92	9.93	92	-95
Non-Sales, Non-FFW (MOF receipts)	540	14.91	806										
Non-Sales, Non-FFW (GOB receipts)	540	0.00	0	540	10.34	559	153	11.38	174	388	9.93	385	-559
FFW	315	14.91	469	315	10.34	325	89	11.38	101	226	9.93	224	144



for distribution through sales channels (such as Open Market Sales, Essential Priorities, etc.), and is equal to difference between the sales price and the economic price multiplied by the quantity of grain sold in each channel. For 2000/01, the estimated food subsidy (for rice and wheat distribution only) was 258 crore Taka.<sup>5</sup> Intra-governmental transfers, (the book costs of non-sales channel distribution apart from Food For Work), were equal to 1244 crore Taka, more than 4.82 times as large as the official food subsidy on rice and wheat.<sup>6</sup>

### COSTS AND BENEFITS OF THE PFDS AT MARKET PRICES

Estimating the actual value of the PFDS to producers and consumers requires an accounting system based on market prices, not on financial prices of the GOB. Market prices change throughout the year, however, affecting the value of procurement and distribution, as well as the value of stocks. Valuing stocks, procurement and distribution and market prices each month permits an analysis of the direct costs and benefits (apart from the effects on price stabilization) of the PFDS (Table 3.2).<sup>7</sup>

For example, in 2000/01, 823 thousand MTs of rice were procured domestically at a total cost of 1219 crore Taka. The average cost of domestically procured rice is thus 14.81 Tk per kg (Tk.12.86/kg fixed procurement price plus Tk1.95/kg for marketing, management etc.). Given an average market value of rice of 11.17 Tk/kg (Tk 9.71/kg producers' price plus Tk 1.46/kg for marketing, management etc.) during the procurement months, the market value of the procured quantity was 919 crore Taka. Thus, the subsidy on domestic rice procurement was 300 crore Taka, (about 55 million dollars).

Government commercial imports are assumed to be procured at market prices. Thus, there is no subsidy on government commercial imports. The market value of imported food aid is calculated as unit cost of government commercial imports times the quantity of food aid. Note that food aid has a negotiated book price higher than the market price of commercial imports.

<sup>5</sup> Subsidies on the sales of vegetable oil are not considered in this report.

<sup>6</sup> Food for Work expenditures are not counted here as part of the food subsidy because they represent wage payments to program participants.

The value of foodgrain to consumers is calculated using the market price in the month in which the foodgrain is distributed. Moreover, rice in excess of 7 months old and wheat in excess of 8 months old is assumed to have a market value equal to only 85 percent of the market price of new foodgrain.<sup>8</sup>

Using this framework, the total net outlay of the PFDS can be decomposed to show benefits and losses (Table 3.3).<sup>9</sup> The consumer subsidy, calculated as the difference between the market price of food and the sales price to consumers multiplied by the quantity distributed, is the largest component of the PFDS, accounting for 57.4 percent of net outlay in 2000/01. The producer subsidy (314 crore Taka, of which 259 crore Taka was for domestic rice producers), accounts for 20.9 percent of total net outlays. Changes in the value of stock due to price effects and quality adjustments represent 11.7 percent of net outlays. The remaining 10.0 percent of net outlays is due to excess valuation of food aid and higher marketing costs of the PFDS in comparison with the private sector.

Implicit losses to rice consumers of quality deterioration were significant in 2000/01: about 105 crore Taka (about 19 million dollars), equal to 10.9 percent of total net outlay on rice of the PFDS. Avoiding quality losses requires either increased shelf life or quicker stock rotation (through distribution or some form of open market sales).

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<sup>7</sup> See Appendix I for a mathematical presentation of the accounting framework.

<sup>8</sup> Assuming that foodgrain stocks are rotated on a first-in first-out basis, the amount of stock at the end of period  $t$  that is age  $x$  months or greater, can be calculated as the end stock level at time  $t-x$  and subtracting total distribution from period  $t-x+1$  through period  $t$ . This figure represents the minimum amount of stock of age 8 months. If stock is not rotated on a first-in first-out basis, then the amount of old stock could be larger.

<sup>9</sup> This report makes no attempt to estimate who actually receives the producer and consumer subsidies. Shahabuddin (1999) provides evidence that few small farmers participate in boro procurement; studies by Ahmed (1992) has suggested that in past years, there have been substantial leakage in foodgrain distribution, as well.

**Table 3.3 — Decomposition of PFDS Net Outlay, Actual 2000/01 (crore taka)**

	Rice		Wheat		Total	
<b>Total Net Outlay</b>	959		543		1502	
Producer subsidy (at market prices)	259	27.0%	55	10.2%	314	20.9%
Excess book value of food aid*	0	0.0%	71	13.2%	71	4.8%
Excess marketing costs	43	4.5%	35	6.4%	78	5.2%
Consumer subsidy (at market prices)	509	53.1%	352	64.9%	862	57.4%
Sales Channels	95	9.9%	70	13.0%	165	11.0%
Non-Sales, Non-FFW	559	58.3%	346	63.7%	905	60.2%
FFW**	-144	-15.0%	-64	-11.8%	-208	-13.8%
Change in stock quality and value***	148	15.4%	29	5.3%	177	11.8%
<b>Total</b>	959	100.0%	543	100.0%	1502	100.0%

Notes: \* Difference between book value of food aid and estimated market value of commercial imports.

\*\* Negative values for FFW indicate that the market price is below the intra-GOB transfer price.

\*\*\* Change in value of stock due to price and quality effects.

#### 4. ANALYSIS OF ALTERNATIVE PFDS STOCK OPTIONS

The framework outlined in the previous section can facilitate an analysis of the benefits and costs of alternative stock policies. Because quality of foodgrain is an important aspect of policy and the GOB currently has no mechanism to rotate stocks apart from PFDS distribution, the level of stocks is closely related to the size of the PFDS. Thus, in this section, we analyze various combinations of stock and distribution levels, estimating financial costs to the government and overall benefits to producers and consumers, (ignoring the possible effects on market price stabilization).

The base scenario is designed to approximate the size of the PFDS in 2000/01, with starting and ending net stocks of rice and wheat (available at the points of distribution) each equal to 400 thousand MTs, and with total distribution of 1.8 million MTs, (850 thousand MTs of rice and 950 thousand MTs of wheat). Month-by-month procurement and distribution in the base scenario (Table 4.1) reflect typical timing and levels of actual procurement and distribution occurred in FY 2000/2001 (Table 4.2). Table 4.1 shows, with near-ideal stock management, only 58 thousand MTs of rice more than 7 months old is distribution in the base scenario. No wheat more than 8 months old is distributed.

If stock is increased to 1.0 million MTs, but distribution is unchanged under Option 1 (Appendix 4.1), the amount of old stock distributed increases to 336 thousand MTs of rice and 170 thousand MTs of wheat, though net outlay is essentially unaffected (Table 4.3). Thus, quality loss as a percentage of net outlay rises from 0.9 percent in the base to 6.5 percent in Option 1 (Table 4.4).

In order to avoid the problems of accumulation of old stock, distribution could be increased along with the target stock levels under Option 2 (Appendix 4.2). In this scenario, however, there is a large increase in net outlay of 163 crore Taka, as increased

distribution is assumed to take place through non-sales channels. The marginal benefit to consumers (and producers) is rather small, however, (only 52 crore Taka) and the marginal benefit/cost ratio is only 0.32 (Table 4.4).

Reducing stock to 0.7 million MTs and keeping distribution at 1.8 million MTs (the level of distribution in the base scenario) under Option 3 (Appendix 4.3), has very little effect on marginal outlay, but results in a minimum rice and total net stock level of only 202 thousand MTs and 625 thousand MTs respectively, at its lowest point during the year.

Finally, under Option 4 (Appendix 4.4), distribution of rice is increased by 50 thousand MTs relative to the base, and wheat stocks are increased by 50 thousand MTs while rice stocks are reduced by 50 thousand MTs. As a result of these changes, quality loss in the system is greatly reduced because no rice stock reaches 7 months of age. The marginal net outlay of 62 crore Taka produces 82 crore Taka of benefits and the marginal benefit/cost ratio is 1.33 (Table 4.4).

Thus, costs and benefits of alternative stock targets are closely related to storage losses and the levels of distribution required to rotate stocks. Increasing the size of stock by moderate amounts, (e.g. 200 thousand MTs in Option 1), leads to only small net marginal outlays, but unless procurement and distribution are also raised, the quality of the stock for distribution deteriorates.

**Table 4.1 — PFDS Stock Flow, 2000/2001 (base scenario)**

(000 metric tons)

Month	Net Opening Stock			ADDITION										OFF-TAKE						Net Closing Stock					
				Domestic			Imports							TOTAL ADDI- TION	Rice			Wheat					TOTAL OFF- TAKE		
	Procurement			Food Aid		Commercial		Total Imports			Distribution		Distribution		TOTAL OFF- TAKE										
	Rice	Wheat	Total	Rice	Wheat	Total	Rice	Wheat	Rice	Wheat	Total	Total	Priced/ Non- Ration Priced			Total Rice	Priced/ Non- Ration Priced	Total Wheat	Rice	Wheat	Total				
Jul	400.0	400.0	800.0	105.0	0.0	105.0	0.0	25.0	0.0	0.0	0.0	25.0	25.0	130.0	11.0	38.0	49.0	12.0	36.0	48.0	97.0	455.0	376.0	831.0	
Aug	455.0	376.0	831.0	50.0	0.0	50.0	0.0	50.0	0.0	0.0	0.0	50.0	50.0	100.0	11.0	38.0	49.0	12.0	36.5	48.5	97.5	455.0	376.5	831.5	
Sep	455.0	376.5	831.5	0.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	50.0	50.0	50.0	11.0	39.0	50.0	13.0	36.0	49.0	99.0	404.0	376.5	780.5	
Oct	404.0	376.5	780.5	0.0	0.0	0.0	0.0	75.0	0.0	50.0	0.0	125.0	125.0	125.0	11.0	41.0	52.0	14.0	36.0	50.0	102.0	351.0	450.5	801.5	
Nov	351.0	450.5	801.5	0.0	0.0	0.0	0.0	75.0	0.0	50.0	0.0	125.0	125.0	125.0	11.0	25.0	36.0	14.0	56.0	70.0	106.0	314.0	503.5	817.5	
Dec	314.0	503.5	817.5	75.0	0.0	75.0	0.0	75.0	0.0	0.0	0.0	75.0	75.0	150.0	11.0	36.0	47.0	15.0	72.5	87.5	134.5	341.0	489.0	830.0	
Jan	341.0	489.0	830.0	200.0	0.0	200.0	0.0	50.0	0.0	0.0	0.0	50.0	50.0	250.0	11.1	72.0	83.1	15.0	52.0	67.0	150.1	456.9	470.0	926.9	
Feb	456.9	470.0	926.9	125.0	0.0	125.0	0.0	50.0	0.0	0.0	0.0	50.0	50.0	175.0	11.3	117.0	128.3	14.0	67.0	81.0	209.3	452.6	437.0	889.6	
Mar	452.6	437.0	889.6	0.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	50.0	50.0	50.0	11.5	115.0	126.5	11.0	92.0	103.0	229.5	325.1	382.0	707.1	
Apr	325.1	382.0	707.1	25.0	150.0	175.0	0.0	50.0	0.0	0.0	0.0	50.0	50.0	225.0	11.7	99.0	110.7	10.0	97.0	107.0	217.7	237.4	473.0	710.4	
May	237.4	473.0	710.4	110.0	120.0	230.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	230.0	11.7	70.0	81.7	10.0	97.0	107.0	188.7	263.7	484.0	747.7	
Jun	263.7	484.0	747.7	175.0	50.0	225.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	225.0	11.7	25.0	36.7	10.0	122.0	132.0	168.7	400.0	400.0	800.0	
Total				865.0	320.0	1185.0	0.0	550.0	0.0	100.0	0.0	650.0	650.0	1835.0	135.0	715.0	850.0	150.0	800.0	950.0	1800.0				

**Table 4.2 — PFDS Stock Flow, 2000/2001 (actual)**

(000 metric tons)

Month	Net Opening Stock			ADDITION										OFF-TAKE							Net Closing Stock			
				Domestic Procurement			Imports				Total Addition	Rice Distribution			Wheat Distribution			Total Off-take						
	Rice	Wheat	Total	Rice	Wheat	Total	Food Aid	Commercial	Total Imports	Priced/ Ration		Non- Priced	Total Rice	Priced/ Ration	Non- Priced	Total Wheat								
Jul	548.2	450.1	998.3	105.6	1.6	107.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	107.2	10.6	0.7	11.2	13.7	14.6	28.3	39.5	641.9	423.1	1065.0
Aug	641.9	423.1	1065.0	101.4	0.0	101.4	0.0	54.1	0.0	0.0	0.0	54.1	54.1	155.4	10.7	0.9	11.6	14.7	41.4	56.0	67.7	730.9	420.7	1151.6
Sep	730.9	420.7	1151.6	9.4	0.0	9.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.4	10.2	3.6	13.7	13.7	44.0	57.7	71.4	726.1	361.3	1087.4
Oct	726.1	361.3	1087.4	99.2	0.0	99.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	99.2	10.3	42.8	53.0	15.4	50.5	65.9	118.9	771.7	294.9	1066.6
Nov	771.7	294.9	1066.6	6.6	0.0	6.6	0.0	27.5	0.0	0.0	0.0	27.5	27.5	34.1	10.9	42.7	53.6	14.4	78.5	92.9	146.5	722.1	229.0	951.0
Dec	722.1	229.0	951.0	45.5	0.0	45.5	2.0	15.3	0.0	0.0	2.0	15.3	17.3	62.8	11.4	55.6	67.0	9.3	97.9	107.2	174.2	700.8	135.6	836.3
Jan	700.8	135.6	836.3	115.7	0.0	115.7	0.0	175.5	0.0	0.0	0.0	175.5	175.5	291.2	11.2	78.5	89.7	9.9	31.0	40.8	130.6	725.2	266.8	991.9
Feb	725.2	266.8	991.9	47.7	0.0	47.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	47.7	10.5	98.1	108.6	9.8	26.5	36.3	144.9	663.3	228.4	891.7
Mar	663.3	228.4	891.7	27.3	5.9	33.2	30.0	100.5	0.0	0.0	30.0	100.5	130.5	163.8	11.4	113.9	125.3	10.0	32.0	42.0	167.3	594.2	292.0	886.2
Apr	594.2	292.0	886.2	0.0	157.9	157.9	0.0	74.5	0.0	0.0	0.0	74.5	74.5	232.4	10.6	134.9	145.5	10.2	49.0	59.1	204.6	447.4	462.6	909.9
May	447.4	462.6	909.9	58.1	58.0	116.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	116.0	11.3	89.7	101.0	10.0	48.8	58.8	159.8	403.3	459.3	862.6
Jun	403.3	459.3	862.6	206.4	41.8	248.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	248.2	9.5	193.9	203.4	8.5	124.4	132.9	336.3	404.4	367.4	771.8
Total				822.8	265.2	1088.0	32.0	447.4	0.0	0.0	32.0	447.4	479.4	1567.4	128.5	855.2	983.7	139.4	638.6	778.0	1761.7			

**Table 4.3 — Alternative Stock Options**

	Base	Option 1	Option 2	Option 3	Option 4
	0.8 mmt net stock 1.8 m dist	1.0 mmt net stock 1.8 m dist	1.0 mmt net stock 2.0 m dist	0.7 mmt net stock 1.8 m dist	0.8 mmt net stock 1.85 m dist
Stock available for distribution ('000 MTs)	800	1000	1000	700	800
Rice	400	500	500	350	350
Wheat	400	500	500	350	450
Lowest available in any month ('000 MTs)	707	895	975	625	715
Rice	237	337	392	202	249
Wheat	376	476	476	326	422
Total distribution ('000 MTs)	1800	1800	2000	1800	1850
Rice	850	850	950	850	900
Wheat	950	950	1050	950	950
Distribution of Old Stock ('000 MTs)	58	506	520	0	8
Rice (>7 months)	58	336	381	0	0
Wheat (>8 months)	0	170	139	0	8
Total net outlay (crore Taka)	1431	1432	1560	1430	1498

**Table 4.4 — Costs and Benefits of Alternative Stock Options**

	Base	Option 1	Option 2	Option 3	Option 4
	0.8 mmt net stock 1.8 mmt distributn	1.0 mmt net stock 1.8 mmt distributn	1.0 mmt net stock 2.0 mmt distributn	0.7 mmt net stock 1.8 mmt distributn	0.8 mmt net stock 1.85 mmt distributn
<b>Total Net Outlay (crore taka)</b>	1431	1432	1560	1430	1498
Excess book value of FFW wages	-153	-179	-187	-150	-149
Adjusted Net Outlay	1584	1611	1747	1580	1646
Marginal Net Outlay	0	27	163	-4	62
Marginal Benefit*	0	-81	52	12	82
Marginal Benefit / Marginal Net Outlay			32%		131%
Quality Loss in as % of Net Outlay	0.9%	6.5%	6.2%	0.0%	0.1%

Note: \* Benefits equal the sum of the producer and consumer subsidies (relative to market prices)

## 5. CONCLUSIONS AND POLICY IMPLICATIONS

Foodgrain stocks serve dual purposes: they provide working stocks for routine distribution and they also serve as security stocks for emergency distribution. However, increases in stock levels imply either increased distribution or quality losses. The direct costs of increased distribution are clearly shown in the government accounts. The costs to consumers of quality deterioration of PFDS foodgrain are not accounted for, however. Closer attention to the quality of foodgrain in storage, and the tight link between size of stocks and the amount of distribution needed to rotate stocks is needed. Thus, decisions on procurement need to be taken in light of the potential costs of increased distribution and quality deterioration of stocks. The accounting framework provided in this report can enhance this analysis by quantifying (even if only roughly) the hidden costs of quality losses for consumers.

Further analysis of these issues might include taking into account the effects of distribution and procurement on market prices. Other analysis might also be done on the costs of alternative minimum stocks for emergency distribution needs, (which were implicitly included in the analysis shown in the preceding sections through attention given to the minimum stock at any point of the year).

Finally, the analysis shows that current stock levels are broadly consistent with the current level of PFDS distribution, given available stock rotation options. Holding higher stocks and keeping distribution constant would entail substantial quality losses, unless alternative means of rotating stocks (e.g. through sales and purchases at open market prices at the wholesale levels) are adopted. Holding lower stocks would result in minimum stock levels falling below currently perceived "safe" levels for emergency distribution needs. Small changes in the stock levels, however, have relatively small effects on costs and benefits of the PFDS. Maintaining good quality storage, effective

stock management and minimizing leakage are more important determinants of the overall PFDS financial efficiency.

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## APPENDIX 1 — DECOMPOSITION OF COSTS AND BENEFITS OF THE PFDS

This appendix presents an accounting framework for assessing the distribution of costs and benefits of the PFDS, including the valuation of stock.

Define the economic price  $P_1$ :

In quantity terms, closing stock ( $STK_1$ ) is equal to opening stock ( $STK_0$ ) plus total procurement (PROC) less stock losses (LOSS) and distribution (DIST).

$$(1) STK_1 = STK_0 + PROC - LOSS - DIST$$

Evaluating all flows at the "economic" price in the current year ( $P_1$ ),

$$(2) P_1 * STK_1 = P_1 * STK_0 + P_1 * PROC - P_1 * DIST - P_1 * LOSS$$

Actual distribution, however, takes place at a price of  $PC_1$ , not at the economic price  $P_1$ . Adding and subtracting the value of distribution, and regrouping the terms, gives:

$$(3) P_1 * STK_1 = P_1 * STK_0 + P_1 * PROC - PC_1 * DIST - (P_1 - PC_1) * DIST - P_1 * LOSS,$$

where the term  $(P_1 - PC_1) * DIST$  represents the consumer subsidy on distribution.

We can also rewrite the value of the initial stock ( $P_1 * STK_0$ ) at the current price  $P_1$  as the sum of the value of the initial stock at the previous period's prices and the change in value of the stock due to price changes:

$$(4) P_1 * STK_0 = P_0 * STK_0 + (P_1 - P_0) * STK_0$$

The resulting equation is:

$$(5) P_1 * STK_1 = P_0 * STK_0 + (P_1 - P_0) * STK_0 + P_1 * PROC - PC_1 * DIST - (P_1 - PC_1) * DIST - P_1 * LOSS,$$

At market prices, the producer price ( $pp_1$ ) plus marketing margins ( $p_1$ ) is by definition equal to the consumer price ( $pc_1$ ). Thus, equation (5) becomes:

$$(6) p_1 * STK_1 = p_0 * STK_0 + (p_1 - p_0) * STK_0 + p_1 * PROC - p_1 * DIST - p_1 * LOSS,$$

as the term  $(p_1 - pc_1) * DIST$  is equal to zero.

Comparing the value of the PFDS stocks and flows at market and at the GOB's financial prices, gives a decomposition of the costs of the PFDS. Subtracting, equation (6) from equation (5), we have:

$$(7) (P_1 - p_1) * STK_1 = (P_0 - p_0) * STK_0 + [(P_1 - P_0) * STK_0 - (p_1 - p_0) * STK_0]$$

+  $(P_1 - p_1) * PROC$  (the total subsidy to producers)

-  $(PC_1 - pc_1) * DIST$  (the total subsidy to consumers)

-  $(P_1 - PC_1) * DIST$  (the financial cost of the PFDS to the GOB)

-  $(P_1 - p_1) * LOSS$  (the difference in the value of losses at market and GOB full cost prices).

**APPENDIX 2.1 — PFDS STOCK FLOW, 1999/2000 (ACTUAL)**

Month	Net Opening Stock			ADDITION										OFF-TAKE							Net Closing Stock				
				Domestic			Imports				TOTAL ADDITION	Rice			Wheat			TOTAL OFF-TAKE							
	Procurement		Total	Food Aid	Commercial		Total Imports	Distribution		Total		Distribution		Total											
	Rice	Wheat			Rice	Wheat		Rice	Wheat		Ration	Priced	Rice		Ration	Priced	Wheat								
Jul	679.4	425.6	1105.0	82.5	1.5	84.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	84.0	11.0	6.3	17.3	9.9	13.3	23.3	40.5	740.6	402.8	1143.4	
Aug	740.6	402.8	1143.4	147.3	0.0	147.3	0.0	7.3	0.0	0.0	0.0	7.3	7.3	154.6	11.6	35.0	46.7	12.3	1.1	13.4	60.0	840.2	395.6	1235.9	
Sep	840.2	395.6	1235.9	14.2	0.0	14.2	0.8	108.5	0.0	0.0	0.8	108.5	109.3	123.5	11.4	47.2	58.6	10.4	2.2	12.5	71.1	792.1	491.3	1283.5	
Oct	792.1	491.3	1283.5	0.0	0.0	0.0	2.4	190.7	0.0	0.0	2.4	190.7	193.2	193.2	12.1	75.2	87.3	14.0	52.8	66.8	154.1	706.7	612.1	1318.7	
Nov	706.7	612.1	1318.7	0.0	0.0	0.0	1.5	210.0	0.0	0.0	1.5	210.0	211.5	211.5	10.9	57.9	68.8	14.0	54.3	68.3	137.1	637.6	748.9	1386.5	
Dec	637.6	748.9	1386.5	33.1	0.0	33.1	0.0	257.0	0.0	0.0	0.0	257.0	257.0	290.1	11.8	19.2	31.0	12.4	91.0	103.4	134.4	639.3	898.4	1537.7	
Jan	639.3	898.4	1537.7	116.7	0.0	116.7	0.0	42.9	0.0	0.0	0.0	42.9	42.9	159.6	11.2	105.7	116.8	15.3	121.7	137.0	253.8	639.1	798.8	1437.9	
Feb	639.1	798.8	1437.9	55.2	0.0	55.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55.2	10.5	28.4	38.9	21.5	71.4	92.9	131.8	655.1	703.1	1358.2	
Mar	655.1	703.1	1358.2	29.7	0.0	29.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.7	11.2	49.9	61.1	15.6	97.2	112.8	173.9	622.7	588.5	1211.2	
Apr	622.7	588.5	1211.2	0.0	104.8	104.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	104.8	11.0	115.6	126.6	10.4	90.4	100.8	227.4	495.4	591.8	1087.2	
May	495.4	591.8	1087.2	81.2	79.4	160.6	0.0	49.5	0.0	0.0	0.0	49.5	49.5	210.1	10.5	74.3	84.9	11.2	142.8	153.9	238.8	490.7	566.3	1057.0	
Jun	490.7	566.3	1057.0	196.5	25.1	221.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	221.6	8.6	129.2	137.8	12.3	127.1	139.5	277.2	548.2	450.2	998.3	
Total				756.5	210.7	967.2	4.7	865.9	0.0	0.0	4.7	865.9	870.6	1837.8	131.8	743.9	875.7	159.3	865.3	1024.6	1900.2				

## APPENDIX 4.0 — OPTIONS ASSUMPTIONS

### 1. Base Scenario:

Stock at points of distribution

- a) 400,400 Stocks – both beginning and end stocks
- b) Peak old stock: rice January 42 >7 months; wheat 0 >8 months
- c) Allowable Wheat losses –20, Rice losses -15

Distribution program based on current programs, typical distribution

- d) Rice Distribution:850
- e) Wheat Distribution:950

Procurement

- f) Wheat domestic procurement: 320; 550 wheat food aid; 100 commercial imports,
- g) Procurement/distribution adjusted to minimize old stock

### 2. Option 1, Ideal 3.2a:

Stock at points of distribution

- a) 500,500 stocks
- b) Peak old stock: rice January 142 >7 months; wheat January 98 >8 months
- c) Allowable Wheat losses –20, Rice losses -15

Distribution program

- d) No change in distribution program versus base

Procurement

- e) No change in procurement versus base
- f) No adjustments to timing of procurement/distribution versus base

Conclusion: lots more old stock, distribution of poor quality grain

### 3. Option 2, Ideal 3.2b

Stock at points of distribution

- a) 500,500 Stocks – both beginning and end stocks
- b) Peak old stock: rice February 148 >7 months; wheat January 78 >8 months
- c) Allowable Wheat losses –20, Rice losses -15

Distribution program

- d) Rice 950 (+100) VGF +70 TR +30
- e) Wheat 1050 (+100) FFW + 100

Procurement

- f) Aman procurement: 450 (+50) boro procurement 515 (+50)
- g) Wheat domestic procurement: 320; 550 wheat food aid; 200 (+100) commercial imports,
- h) Procurement/distribution not optimized to minimize old stock

Conclusion:

- still lots of old stock, distribution of poor quality grain; if domestic rice procurement, little choice in timing of procurement of rice...
- some aman/boro choice to remove bad stock would require rotation 2x per year
- more flexibility in timing of procurement, distribution needed, as well as greater ratio of distribution to procurement

**4. Option 3, Ideal 3.2c:**

## Stock at points of distribution

- a) 350,350 Stocks – both beginning and end stocks
- b) Peak old stock: no old stock
- c) Allowable Wheat losses –20, Rice losses -15

## Distribution program

- d) Rice 850 no change
- e) Wheat 900 (-50) FFW –50

## Procurement

- f) Rice procurement no change
- g) Wheat domestic procurement: no change; -50 commercial imports
- h) Moved 25 rice procurement from May to January

## Conclusion:

- Lower outlay on wheat procurement but lower receipts from FFW –
  - essentially no change in outlay

**5. Option 4, Ideal 3.2d 800- Stocks with more wheat:**

## Stock at points of distribution

- a) 350,450 Stocks – both beginning and end stocks
- b) Peak old stock: no old stock
- c) Allowable Wheat losses –20, Rice losses -15

## Distribution program

- d) Rice 850 no change
- e) Wheat 900 (-50) FFW –50

## Procurement

- f) Rice procurement no change
- g) Wheat domestic procurement: no change; -50 commercial imports
- h) Moved 25 rice procurement from May to January

## Conclusion:

Lower outlay on wheat procurement but lower receipts from FFW.