Reducing Vulnerability to Natural Disasters

Lessons from the 1998 Floods in Bangladesh

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1 Introduction

In Bangladesh, poverty, hunger, and malnutrition are widespread and the struggle to achieve food security is ever present for tens of millions of people. About half of the population is still too poor to afford enough food to sustain a healthy and productive life. Nonetheless, the country has made substantial progress since the mid-1970s in enhancing food security and reducing vulnerability to disasters by increasing production of rice and wheat, improving its infrastructure, making food delivery to the poor more efficient and liberalising its markets.

In 1998, Bangladesh was devastated by the worst flood of the century. At its peak in early September 1998, the flooding covered two-thirds of the country, causing severe damage to the major rice crop (a total of 2.2 million tons of rice crop losses, equal to 10.45 per cent of target production in 1998/9) and threatening the food security of tens of millions of households.

In spite of the damage to the rice harvest and major disruption of the rural economy and employment opportunities, no famine or major food crisis occurred. There were very few flood-related deaths, and reportedly none occurred due to food shortages. Poor households did suffer substantial hardship during and after the floods, but the combination of well-functioning private markets and government, donor and NGO interventions to a large extent maintained availability of and access to food. Overall, though, the success in handling the effects of the 1998 flood stands in sharp contrast to the famine caused by the flood in 1974, which contributed to tens of thousands of deaths.

This article summarises the results of several research reports and other publications in describing how the 1998 flood affected food security in Bangladesh at the national and household levels, the response of the government to the crisis, and the coping strategies employed by the households themselves.[1] It then highlights policy lessons for the management and reduction of the adverse impact of future natural disasters.

The analysis summarised in this article is based on secondary data on market prices, imports and production, along with primary data from a multi-round survey of 757 households in seven flood-

affected *thanas*, conducted in December 1998 (about 2.5 months after the floodwaters had receded), April–May 1998, and December 1999.

2 Foodgrain markets and the policy response in 1998

At the sectoral level, the Government of Bangladesh and donor officials were keenly aware of the potential flood damage to the main monsoon season (*aman*) rice crop and threat to foodgrain availability, even while the immediate relief operations were underway. Thus, the Government launched an appeal for international flood relief and food aid in August 1998, anticipating that by the time the floodwaters receded, it would be too late to replant a large portion of the *aman* rice area. Donors ultimately responded by delivering 1,233 million tons of food aid in 1998/9, but from October through December 1998, government distribution of foodgrains was constrained by the lack of available public stocks. Thus, public foodgrain distribution from July to December 1998 was only 631 tons greater than planned before the flood.

Despite only a small increase above previously scheduled supplies through government channels in the last six months of 1998, markets were stabilised by private sector imports of rice and wheat. Inflows of 1.3 million tons of rice from India during this period (and over 2.5 million tons by June 1999)[2] kept prices from rising above import parity levels following the flood.

Evidence from letters of credit for rice imports shows that large numbers of traders participated in the (mostly overland) rice import trade, with an average contract size of 269 tons in 1998. Thus, private markets appear to have worked competitively to limit the price increases to only 12.4 per cent from May–July to August–December 1998. Moreover, price variations were of a similar magnitude across various regions of Bangladesh – further evidence of well-functioning domestic markets.

3 A comparison with earlier major production shortfalls

Clearly, private sector imports played a major role in stabilising rice and wheat markets following the 1998 floods. Government policy in three earlier periods of major foodgrain production shortfalls caused by floods in 1974, 1984 and 1988 depended much more heavily on public sector market interventions. In 1974, a large-scale famine, resulting in between 30,000 and 100,000 deaths, followed floods that damaged *aus* and *aman* rice crops (normally harvested in July–August and November–December, respectively).[3] In contrast, flood damage to the *aus* rice crop in 1984 and to the *aman* rice crop at the end of 1988 caused sharp declines in production, but no famines occurred.

3.1 The 1974 famine

The 1974 famine was characterised by a very sharp rise in nominal (and real) rice prices following the floods in July. As in 1998, the floodwaters were late in receding, leading to expectations in the media and the markets of large crop losses in the *aman* rice crop due to be harvested in November–December. Rice prices in August through November 1974 were on average 58.2 per cent higher than in May through July 1974. This sharp rise in prices had disastrous consequences for poor households lacking the entitlements to acquire enough of their staple commodity.[4] Ravallion (1990) argued that this large increase in rice prices was a major cause of famine deaths, as calorie consumption fell below survival thresholds. In contrast to 1974, however, rice prices rose by only 7.0 per cent in these months following the floods in 1988/9 and by 12.4 per cent in 1998/9.[5]

This difference in market price behaviour is not explained by the size of the production shortfall. As shown in Table 1, in comparison to trend *aman* rice production, the *aman* shortfalls in 1988 (18.1 per cent) and 1998 (18.0 per cent) were much larger than the 1974 *aman* shortfall (8.5 per cent). Instead, speculative behaviour by traders appears to have played a major role in the 1974 price increase.[6] In addition, traders appear to have believed (correctly) that the government would be unable to intervene effectively to stabilise market prices in the event of a production shortfall, because of extremely low public stocks at the time of the flood (only 27,000 tons at the end of July 1974),[7] shortage of foreign exchange reserves for commercial imports,[8] extremely high world foodgrain prices, and delays in US food aid deliveries.[9] Because of the shortfall in stocks, public distribution of foodgrain was severely limited, particularly in rural areas.

Table 1: Availability, stocks and market prices in major flood years in Bangladesh

Foodgrain production	1974/5	1984/5	1988/9	1998/9
Aman (million tons)	6.29	7.93	6.86	7.74
Below trend (%)	-8.5	-0.1	-18.1	-18.0
Total rice shortfall (calendar year, million tons)	-0.608	-0.641	-0.241	-0.701
Per capita production (kg/person)				
Rice (calendar year)	149.1	144.9	136.6	138.8
Wheat (calendar year)	1.2	12.5	9.9	14.3
Total foodgrain (calendar year)	150.3	157.4	146.6	153.1
Total foodgrain (fiscal year)	149.5	164.2	155.1	171.7
Aus and *aman* share of production (%)	80.3%	73.3%	62.5%	47.0%
PFDS distribution (July–June)				
Total rice (thousand tons)	131	399	690	530
Total wheat (thousand tons)	1,597	2,163	2,251	1,603
Targeted rice (thousand tons)	4	6	167	386
Targeted wheat (thousand tons)	157	905	1,259	1,488
PFDS distribution (Aug–Nov)				
Total rice (thousand MT)	43	201	231	216
Total wheat (thousand MT)	616	891	700	223
Targeted rice (thousand MT)	2	0	83	172
Targeted wheat (thousand MT)	87	298	287	186
Foodgrain imports (July–June)				
Private rice imports (thousand tons)	0	0	0	2,663
Public rice imports (thousand tons)	267	695	61	393
Private wheat imports (thousand tons)	0	0	0	805
Public wheat imports (thousand tons)	2,030	1,898	2,075	1,603
Per capita availability (fiscal year)				
Rice (kg/person)	133.26	136.99	134.07	162.31
Wheat (kg/person)	21.76	33.32	29.19	30.46
Total foodgrain (kg/person)	155.03	170.31	163.26	192.77
National wholesale prices				
Rice: average (May–July)	359	778	884	1237
Rice: average (August–November)	568	807	946	1390
Rice: percent change[a]	58.2%	3.7%	7.0%	12.4%
Wheat: average (May–July)	256	438	538	857
Wheat: average (August–November)	413	495	620	949
Wheat: percent change[a]	61.2%	12.8%	15.3%	10.7%
Public foodgrain closing stocks				
End July stocks				
Rice (thousand MT)	27	101	710	438
Wheat (thousand MT)	293	651	784	273
Total (thousand MT)	320	752	1494	711

Table 1 (continued)

Foodgrain production	1974/5	1984/5	1988/9	1998/9
Average (August–November)				
Rice (thousand tons)	21	223	621	359
Wheat (thousand tons)	187	413	546	310
Total (thousand tons)	208	636	1167	669
Average (August–November)				
Rice (kg/person)	0.3	2.3	5.8	2.8
Wheat (kg/person)	2.4	4.2	5.1	2.4
Total (kg/person)	2.7	6.5	10.9	5.3
Foreign exchange reserves (US$million)	175	545	863	1,744
Cost of rice imports/FE reserves[b]	1.22	0.29	0.07	0.10
Mid-year population (millions)	78.2	98	106.8	127

Source: del Ninno, Dorosh and Smith (2001), FPMU (2001).

a Percentage change from May–July average to August–November average.

b C+F price of rice times rice shortfall (calendar year) divided by foreign exchange reserves.

3.2 The 1984 flood

The situation after the flood in 1984 was very different. Although successive floods in the early part of 1984 led to great fears of damage to the *aus* crop (July–August) as well as expectations of shortfall in the *aman*, the floodwaters receded much earlier in 1984 than they did in 1974, eventually easing concerns of large *aman* crop losses. Total decline in rice production in calendar year 1984 of 641,000 tons was, nevertheless, 33,000 tons greater than the decline in production in 1974.

Improvements in the government's capacity to monitor production and markets enabled it to take early steps to dampen speculative pressures in 1984 by importing food (Clay 1985).[10] Adequate foreign exchange made commercial purchases possible and food aid flows were not restricted. Total foodgrain imports in 1984/5 reached 2.8 million tons, about 700,000 tons higher than that in 1983/4. (Food aid was 1.49 million tons and 1.54 million tons respectively in the two years.) Given these substantial imports, public stocks were soon built up and reached a level equal to more than four times what was available in 1974. The average public distribution of food during the crucial months of July–September 1984 (758,000 tons), was double the average distribution during these months in the preceding three years. Total public distribution of food during 1984/5 was 2.56 million as against 1.7 million tons during 1974/5.[11]

3.3 The 1988 flood

The 1988 flood, like the flood that occurred ten years later, caused severe damage to the *aman* rice crop: production was only 7.7 million tons, 578,000 tons less than the December 1987 crop and 18.1 per cent below trend. Total rice production in the calendar year 1988 was only 241,000 tons below that of the previous calendar year, because somewhat less serious floods reduced total rice production in 1987 as well.

As in 1984, the government of Bangladesh responded to the shortfall with increased distribution of food, with rice distribution supplied almost entirely from existing stocks rather than commercial imports. Government foodgrain stocks averaged 1.2 million tons from August through November 1998; rice stocks accounted for slightly more than half the total, averaging 621,000 tons. Total distribution of foodgrain in 1998/9 was 2.94 million tons, much of this channelled through large-scale rationing programmes that involved subsidised sales. These sales channels were plagued with substantial leakages, however, that eventually led to their elimination in the early 1990s (Ahmed *et al.* 2000).

Table 2: Mean values of household variables for all households and those who were flood-exposed and in the bottom 40 percentile

	November 1998	April 1999	November 1999
Bottom 40% flood-exposed households			
Per capita expenditure (Taka)	424	516	505
Share of expenditure on food (%)	72.62	80.02	78.86
Per capita daily calorie consumption (kcal)	1,602	2,230	2,193
Households having outstanding debts (%)	75.22	68.58	64.16
Debts as share of total monthly expenditure (%)	167.48	126.85	106.07
Level of malnutrition (% children stunted)	64.86	69.59	64.90
All households			
Per capita expenditure (Taka)	751	683	677
Share of expenditure on food (%)	67.97	77.15	76.12
Per capita daily calorie consumption (kcal)	2249	2518	2526
Households having outstanding debts (%)	66.31	60.63	53.63
Debts as share of total monthly expenditure (%)	131.56	90.42	87.10
Level of malnutrition (% children stunted)	54.80	62.98	57.18

Source: FMRSP–IFPRI household survey 1998–99.

3.4 Implications for public stocks

Stocks in 1998/9 were significantly larger than in 1974/5 in the crucial August to November months: 669,000 tons, or 5.3 kg per person, twice the *per capita* stocks of 1974/5, although only half those of 1988/9.[12] Several factors suggest that the need for public stocks to avert famines in Bangladesh has considerably decreased since 1974, however. First, the record 10.55 million tons *boro* harvest in May/June 1999, only five to six months after the failure of the *aman* crop, shortened the period of uncertainty regarding domestic supply, increasing foodgrain availability, raising farmer incomes and reducing prices.[13] Production of wheat, another winter season crop, played a similar role in increasing food supplies, increasing from only 1.2 kg *per capita* in 1974 to 12.5 and 14.3 kg *per capita* in 1984 and 1998, respectively.

Second, as shown above, private sector imports have added to domestic supplies and quickly stabilised prices at import parity levels following *aman* crop shortfalls in 1997/8 and 1998/9. Third, rice markets in Bangladesh are now much better developed than in 1988/9, and especially compared with 1974/5, so shortages across regions within the country can be more easily met by domestic private (and public) grain flows. (Public sector imports, an alternative to private sector imports, encountered serious problems with tenders in 1998/9 and were not a significant source of supply.) Fourth, foreign exchange constraints, which so severely hampered government efforts to procure rice in 1974, had been greatly eased through increased export earnings and availability of commercial and official credit. Finally, international markets for rice and other grains have grown deeper and more stable, so the risk of facing high international prices has lessened.[14]

4 Losses of crops, assets and earnings from employment

Despite success in stabilising markets, households still suffered because of floods. Crop losses (particularly rice crop losses) due to the flood were substantial. Some 45.7 per cent of households surveyed, which produced a crop in the previous 12 months, suffered crop losses averaging Taka 2,975, equivalent to 29 per cent of their production.

For the 55 per cent of households that lost assets, their average loss was Taka 6,936, equivalent to 16 per cent of the total value of their pre-flood assets. In all, 47 per cent of households suffered damage or loss to housing, with the average loss equal to Taka 5,675, or 59 per cent of pre-flood housing value.

Table 3: Coping strategies, flood exposure and poverty in November 1998

	Flood exposed					
	Bottom 40%	Middle 40%	Top 20%	All	Not exposed	All households
Monthly households expenditure (Tk)	2,414.3	3,973.9	7,720.6	4,063.6	3,843.5	4,000.5
Share of food expenditures (%)	72.4	69.5	62.2	67.4	68.4	67.7
Households in debt (%)[a]	68.2	58.9	62.6	63.5	53.5	60.6
Share of monthly expenditure (%)[a]	186.1	138.7	131.3	144.4	140.2	143.6
Household purchasing food on credit (%)	56.7	54.1	50.5	54.4	29.5	47.3
Share of monthly expenditure (%)	37.6	27.2	17.3	25.8	20.0	25.0
Households receiving government transfers (%)	60.7	54.1	32.7	52.6	33.6	47.2
Share of monthly expenditure (%)	3.4	2.4	0.8	2.0	2.1	2.0
Households selling assets (%)	25.2	21.3	15.9	21.9	20.3	21.4
Share of monthly expenditure (%)	45.5	51.3	75.3	51.9	44.2	49.9
Number of households	226	207	107	540	217	757

Source: del Ninno, Dorosh, Smith and Roy (2001).

a Data reported here differ slightly from the data in Table 2, because this table does not include additional recall information collected after the first round of the survey.

The rural economy suffered serious disruption from the floods as well. Average monthly days of paid work went down in the period of the flood, but increased in the period after the flood to the same level as 12 months before the flood for all workers except daily labourers. Daily labourers were most affected as their employment fell sharply from 19 days per month from July to October 1997, to only 11 days per month in the same months in 1998. Similarly, wage earnings also declined during the floods and had not recovered to 1997 levels by October–November 1998. For daily labourers, average monthly earnings in July–October 1998 were 46 per cent below those in the same months in 1997, and in October–November 1998 they were still 18 per cent below the 1997 levels. This decline in number of days worked and wage earnings occurred in the context of a labour market with little open unemployment. Thus, underemployment increased as workers worked fewer days, but most workers found at least some employment.

Within eight months of the flood, as agricultural production and rural employment recovered, household incomes rose substantially, for both flood-exposed households as well as those not directly exposed. The average monthly income of all households in the sample was 45 per cent higher in April 1999 than in November 1998 and about 50 per cent higher in November 1999. The income level of flood-exposed households also increased, by 35 per cent between November 1998 and April 1999 and by 49 per cent between November 1998 and November 1999. However, the incomes of poor flood-exposed households did not increase as much as the other households.

5 Consumption, health and nutrition

In the first few months after the flood, borrowing from the informal sector enabled households to increase spending on key non-food items (health, housing and fuel), while maintaining total expenditures on food. Average *per capita* household expenditures were actually higher in November 1998 (Taka 751) than in April 1999 (Taka 683) or November 1999 (Taka 677) (Table 2).

However, because of higher prices of rice, vegetables and many other foods in November 1998, actual calorie consumption in this period was significantly less than in the two subsequent periods (2,249 calories/person per day, compared with

2,518 and 2,526 calories/person per day) (Table 2). Calorie consumption of the poor was even more sharply affected, falling to only 1,602 calories *per capita*/day among the poorest 40 per cent of flood-exposed households in November 1998, as compared with about 2,230 calories *per capita*/day in April 1999 and 2,193 in November 1999.

Econometric analysis suggests that had rice prices increased even more than the 12.4 per cent increase that actually occurred (from May–July average to August–November average), calorie consumption would have declined further. Without private sector cross-border trade from India, rice prices would likely have been at least 19 per cent higher (to a level equal to the import parity price of rice from Thailand) and total calorie consumption of the poor would have fallen by an additional 44–109 calories, to 1,529–1,596 calories/person per day (del Ninno, Dorosh and Smith 2001). Food transfers also contributed to increased calorie consumption, though to a lesser extent. In the absence of these transfers, *per capita* consumption would have fallen by an additional 20–25 calories/person per day.

The flood also left a major deterioration in the quality of households' health environments in its wake, damaging or destroying peoples' homes and toilet facilities, and reducing their access to safe drinking water. These factors, combined with the reduction in food consumption, led to substantial increases in illness – even after the floodwaters had partially or totally receded. 9.6 per cent of individuals in the sample suffered from diarrhoea, and 4.7 per cent were affected by respiratory illness in the immediate post-flood period (November 1998). While adolescents faced the greatest increase in illness, the most serious health problem posed by the flood was illness among children (del Ninno, Dorosh, Smith and Roy 2001). The incidence of both wasting and stunting increased among preschool children due to a combination of factors, including reduced access to food, the increased difficulties of providing proper care for children that came with disruptions in home life, and the greater exposure of children to contaminants.

For poor households, these adverse effects on nutrition were not merely short-term, however. In November 1998, 65 per cent of children in poor flood-exposed households were stunted. This figure actually rose to 70 per cent by April 1999, perhaps because of a lag between a period of deprivation and the resulting malnutrition. By November 1999, the percentage of stunted children in these households had fallen back to 65 per cent, the same level as 12 months earlier, while the stunting of children in non-flood-exposed households declined dramatically, from 57 per cent in November 1998 to only 44 per cent one year later (Table 2). Econometric analysis by del Ninno and Lundberg (2001) confirms that 15 months after the flood (November 1999), most children appear to have regained the same nutritional status they had a few months after the flood (November 1998). Unfortunately, those children that had a very poor nutritional status in November 1998, and were exposed to the flood (over 40 per cent of the sample), had not regained the same level of nutritional status a year later.

6 Household response and government targeted distribution

Households adjusted to the shock of the flood in several major ways, including reducing expenditures, selling assets and borrowing. Borrowing to purchase food and to fund other expenses – such as education, health, farming, business, repayment of loans, marriage and dowry, purchases and mortgage of land or agricultural equipment – was the most important coping strategy employed by households in Bangladesh after the flood, in terms of both the value of the resources and the number of households who borrowed.

More than 60 per cent of poor, flood-exposed households in the sample borrowed money in the months immediately following the flood, and of these more than half borrowed money for food. Household debts rose to an average of 1.5 months of typical consumption, compared with only a small percentage of monthly consumption in January 1998, about 8 months before the floods (Table 3). Households borrowed mostly from non-institutional sources such as friends and neighbours rather than from NGOs and banks. Interest rates on the loans ranged from 21 per cent, from institutional sources, to a maximum of 67 per cent.

The percentage of households with outstanding debt one year after the flood (as reported in Table

2) decreased progressively from November 1998, when it peaked with 66 per cent of the households holding an average of Taka 7,937 in outstanding debt, to 54 per cent in November 1999 holding Taka 6,497 each. Despite this improvement in the number of households in debt and the amount of their debt, it still constitutes a large share of total expenditure and leaves those households vulnerable to further shocks. Debts as a share of total monthly expenditure in November 1998 were 167 per cent for the poorest 40 per cent of flood-exposed households and 132 per cent for all households.

In response to the flood, the government of Bangladesh implemented two main direct transfer relief programmes. In the initial flood period, immediate relief through the Gratuitous Relief programme went mainly to seriously flood-exposed households; 35.7 per cent of severely flood-exposed households received the transfer compared with 9.7 per cent of non-exposed households. Vulnerable Group Feeding transfers started in late October and were targeted administratively through union-level committees. They were better targeted to the poor than to the flood-exposed households: 38.8 per cent of the households in the bottom quintile received grain transfers compared to 17.2 per cent and 11.2 per cent in the top two quintiles. Almost 20 per cent of the non-flood exposed households received transfers as well (del Ninno and Dorosh 2001).

However, government transfers were small relative to the needs of households, as indicated by the share of the transfers compared to monthly expenditures. Small cash transfers were part of the initial flood relief efforts, but larger cash transfers or credit programmes were not part of the medium-term relief to households 2–4 months after the floods, even though foodgrain stock constraints limited the expansion of the Vulnerable Group Feeding programme during this period.

Eliminating borrowing following the flood would have required a transfer of approximately Taka 5,000 (about US$100) for each of the 60 per cent of households still in debt in December 1998. Nationwide, total private borrowing by households may have reached US$1.0–1.5 billion, equivalent to 15–20 per cent of total government expenditures in 1998/9, compared with about US$0.6 billion of annual loan disbursement by Grameen and BRAC put together.

7 Conclusions

The studies summarised in this article have shown that well-functioning private markets, suitable government policies, and interventions by government and non-governmental organisations worked together with effective private coping strategies to prevent a major food-related disaster after the 1998 flood in Bangladesh.

The aftermath of the 1998 flood stands in sharp contrast to 1974, when thin private markets, poor infrastructure, inadequate government stocks, limited public food distribution in rural areas, and foreign exchange shortages contributed to extreme price increases and famine. Subsequent to 1974, Bangladesh successfully managed major flood-related production shortfalls in 1984 and 1988, through large-scale, mostly untargeted, public foodgrain distribution supplied mainly from government stocks. Major changes in food markets and the overall economic environment suggest, however, that large public stocks are not required to avert famines in Bangladesh. Instead, greater reliance on markets is a viable policy option because of long-term investments in rural infrastructure, and agricultural research and extension that have augmented domestic foodgrain production, reduced seasonality of supply (through increases in winter season *boro* and wheat crops) and contributed to more efficient domestic rice markets. Moreover, trade liberalisation, greater availability of foreign exchange, and deeper international markets for rice and other grains have made it possible for private sector imports to add rapidly to domestic supplies in times of shortage.

The country's trade liberalisation of the early 1990s made possible the large-scale private sector rice imports following the flood, adding more than 2 million metric tons to Bangladesh's rice supply, stabilising rice prices and preventing a further serious decline in calorie consumption of the poor. Government public foodgrain distribution was well-targeted to poor and flood-exposed households, improving household food security and helping to offset some of the adverse effects of the flood by (marginally) increasing calorie consumption.

Although a major food crisis was averted in 1998, the poor did suffer, both in the short term through reduced consumption and increased illness, and in the medium term through increases in household debt and lingering nutritional consequences. The major coping strategy of households in the first three months after the flood was to borrow from private sources. Over time, however, this reliance on private sector borrowing had adverse implications for food security and economic growth. Fifteen months after the flood, the country's poorest households still laboured under high levels of debt.

Thus, the experience of the 1998 Bangladesh flood illustrates the crucial role that private markets and appropriate government investments and policies can play in maintaining food availability, limiting price increases and supplementing household access to food. Additional policy measures could further mitigate the negative impact of natural disasters, including (1) agricultural and investment policies to increase agricultural productivity and rural incomes, (2) investments in infrastructure to help maintain efficient and competitive foodgrain markets, (3) policies and programmes to reduce chronic malnutrition among children and thereby soften the negative impact of natural shocks, and (4) targeted cash transfers and credit programmes to disaster-affected households, to enable them to avoid long-term debt.

Notes

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1. See del Ninno, Dorosh, Smith and Roy (2001); del Ninno, Roy and Mukherjee (2001); del Ninno and Dorosh (2001); Dorosh (2001) and del Ninno, Dorosh and Smith (2001).
2. The figures given are official statistics from the Bangladesh government. Calculations of implicit food demand and Indian export data suggest that the actual quantity of imports may have been as much as 1.0 million tons lower (Dorosh 2001).
3. The official death toll from the 1974 famine was 30,000 (Alamgir 1980); unofficial reports cited in Sobhan (1979: 175) were as high as 100,000.
4. Wheat prices also rose by 61.2 per cent in the same period.
5. See also Islam (1997) for a further discussion of the 1974 famine.
6. Ravallion (1985, 1990) provides econometric evidence that exaggerated reports of crop failure influenced traders' expectations and led to 'excessive hoarding' of stocks.
7. Private and public stocks were already low because of consecutive bad harvests in the preceding years, in part caused by the dislocation of production and trade during the 1971 war. Public stocks declined from an average of more than 300,000 tons in 1972/73 to between 140,000 and 172,000 tons during January–April 1974.
8. Foreign exchange reserves during the first and third quarters of 1974 were only one half and one quarter of what they were during the corresponding periods in 1973.
9. Requests for 250,000 tons of food aid in mid-1973 and an additional 400,000 tons in mid-1974 were delayed mainly because of jute exports by Bangladesh to Cuba, which violated US conditions for aid. No US food aid arrived until November 1974, by which time the worst days of famine were over (see Sobhan 1979).
10. In spite of vast improvements in the quality and timeliness of information on markets and production since 1974 (and 1984), further development of an early warning system for production shortfalls is warranted.
11. Note also that in 1974/5, most of the distribution took place in early 1975, after the 1974 *aman* harvest, when the famine was over.
12. Discouraging private speculation was a major Ministry of Food rationale for maintaining a relatively high level of stocks during these crucial months in 1998/9. Early assurances of food aid by donors may also have contributed to calming markets in Bangladesh.
13. The record 1.91 million ton wheat harvest in March and April 1999 also added to food availability soon after the *aman* crop shortfall.
14. In addition, replacement of flood-susceptible deepwater *aman* cultivation by irrigated *boro* cultivation in cropping patterns has reduced the production risk associated with floods (Hossain, Bose and Chowdhury 2001).

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