Estimation of Private Stock of Rice in Bangladesh: In Search of a Practicable Methodology

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1 Background

A reasonably good estimate of the private stocks of food grain over time is necessary for proper formulation and implementation of public policies on domestic food grain procurement, import and disposal. This necessity remains relevant whether the policy objective is to create a buffer stock, or a security stock or to meet emergencies due to natural calamities or to intervene in the market alongside the private sector to ensure a socially optimal level of stock over time.

In the context of Bangladesh, private stocking of food grains as an activity takes place at two levels – households and traders. In terms of stocking objectives, households can be divided into two main groups – food grain producing households and non-producing households. Food grains are harvested at specific times during a year but consumption is spread over longer periods. So producers need to maintain stocks to smoothen consumption. In addition, all or some producers may sell part of the produce, so the nature, extent and duration of stock will depend on consumption needs and the expected pattern of sales – volume and time of sale and related reasons, e.g. sales to generate cash irrespective of the price level or sales in response to market price to maximize profit. On the other hand, non-producing households and households producing insufficient quantities for own consumption may buy and stock food grains of different volumes for different durations depending on present prices and their perception and expectation about future prices. The objective of stocking in this case is primarily to avoid having to buy at an unreasonably high price in the future compared to the current price.

Traders usually stock for temporal arbitrage, i.e. to benefit from differences in the current purchase price and sale price at a future date. The actual inventories or volume, form and duration of stock depends on the operational need of the type of business, e.g. simple speculative buying and selling, spatial arbitrage of different degrees and value adding activities like processing along with speculative buying and selling.[1]

Thus the nature and extent of private food grain stocks are dependent on a range of factors related to the structure of food grain production, consumption, marketed surplus and pattern of marketing by producers, and of the structure and conduct of food grain market (Chowdhury, 1993). The flow of food grains and prices in the market will depend on marketed surplus of producers and their marketing patterns as well as the stocking and marketing behaviour of traders.

Literature on food grain marketing in Bangladesh is very thin compared to those on food grain production. Few studies that were conducted on food grain marketing addressed questions of the extent of marketed surplus, extent of competition and efficiency in the market, the degree of market integration and informational inefficiency, and the role of pre-harvest credit on marketing behaviour of producers. The aspect that has been

[1] Normal stocking for speculative purposes in a competitive market environment is distinguished from 'hoarding' which is the situation in which one or more agents (normally few and large enough to control a large share of the market) stock to create artificial scarcity for the only purpose of pushing prices up above the levels expected under competitive conditions in order to realize super-normal profits.

virtually ignored in marketing studies is the estimation of private grain storage or stock at a point in time at producer and trader levels, and how private and public stocks interacted to influence food grain market (Chowdhury, 1992).

Prior to the agricultural trade liberalization, the Ministry of Food used to get information on trader level stocks of rice and wheat directly from the private traders and millers, who, under statutory provision, were obliged to provide periodic stock statements to the Directorate of Food. Following trade liberalization in 1992, this provision was removed, which created an information gap regarding actual levels of trader stocks.

In view of the above, this paper has the following objectives in relation to estimation of marketed surplus and private stock of rice, the principal food grain in the country:

- To review the available evidence on marketed and marketable surplus of rice and the trend and pattern of marketing and private stocks of rice giving attention to methodologies employed in the generation of those data, and identification of methodological gaps, if any, that might require further research.
- Based on the outcome of the review, propose a practical methodological framework for monitoring private stocks of rice at regular intervals and at minimum cost without compromising on the quality of the results.

The review of literature on marketed surplus is presented in section 2, on private stock in section 3 and a summary and proposed framework in section 4.

2 Review of evidence on marketed and marketable surplus of rice

2.1 Defining marketed and marketable surplus

In the past, smallholder subsistence oriented producers in Bangladesh as elsewhere in the developing countries used to produce food grain primarily for home consumption and for selling any surplus to earn cash income. Smallholders' preference for home produced food emanated from their efforts to avoid market risks, especially risks of possible high price in the off season when they needed to buy food. However, production and market participation increased over time with introduction of improved technologies which contributed to increase income and welfare of producers as well as consumers. In theory, a fully market oriented farmer may produce anything that is profitable, and buy food grain from the market.

Marketed surplus of food grain among smallholder producers is of interest to researchers and policy makers because market participation is essential for farmers for raising farm income and welfare.[2] Also adequate regular supply of food grain in the market is essential to keep food prices at affordable levels for consumers. As the economy develops, number and proportion of population engaged in agriculture usually decline though the size of the overall population increase. Consequently, food grain producers need to produce not only enough for themselves but also for an expanding non-producing consumer in both rural and urban areas so that dependence on import or aid can be avoided or at least minimized. On the other hand, if surplus above national food need is produced, then there will be scope for export of food grain to raise both producers' and national income. Understanding marketed surplus and marketing behaviour of producers helps design technology, policy and institutions to facilitate the process of commercialization of agriculture.

In some of the early studies on food grain marketing in South Asia as elsewhere in the developing countries, three concepts of marketed surplus are generally found – gross marketed surplus, net marketed surplus and marketable surplus (see for example Narain,1961; Krishna,1962; Krishnan,1965; Raquibuzzaman,1966; Sharma and Gupta,1970; Farruk,1970; Bhargava and Rustogi,1972; Rahman,1980; Harriss,1982; Hussein and Rajbanshi,1985).

Gross marketed surplus has been generally defined as sales as a share of current gross output. But sometimes, rather than gross output, net output after deduction for 'seed, feed and waste' has been used as the base. The logic behind this deduction is that in smallholder production systems, most producers have to depend on own seed as seed market is not well developed, and there is some on-farm wastage due to storage, processing and other reasons, and some grains, especially low quality ones, may be fed to

[2] Wharton Jr (1963) distinguished three different meanings of subsistence. Subsistence production – production only for home consumption; subsistence consumption – level of consumption equivalent to minimum biophysical needs; subsistence income – a level of income that allows subsistence level of living. Thus a farmer may participate in the market yet enjoy only subsistence level income or consumption.

livestock, which are an essential component of smallholder mixed farming systems. So a portion of the gross output is usually not available for sale, hence marketed surplus is estimated as a ratio of output net of these requirements.

Net marketed surplus is usually calculated as sales minus purchases as a share of gross or net output. Marketing studies have shown that smallholder producers may sell because they have a surplus over family needs for consumption but some producers also sell as well as buy for a variety of reasons, e.g. sell after harvest to meet immediate cash needs and buy back later; some may buy because they do not produce enough for own consumption; yet others may sell some variety that they do not like or prefer and buy back those they do.[3] Such transactions may occur between producers or between producers and various market agents but a portion of the sold output are bought back by the producers. Thus net marketed surplus measures the size and share of net output available for non-producing consumers, and where applicable for export, after inter-farm sales are netted out.

Marketable surplus is measured to assess whether a producer has the real capacity to sell above own consumption needs, irrespective of whether the producer actually sells or not. If gross or net marketed surplus of a farmer is positive, marketable surplus may or may not be positive. Sales under condition of negative marketable surplus may have welfare implications if the sales are of a distress nature and arise due to compelling cash needs that can't be generated otherwise. From a livelihood perspective, for smallholders' marketable surplus is a useful concept as it allows to see under what conditions they sell and if that improves their welfare. It is particularly useful so long as own produced food grain is preferred to secure food and protect food security under conditions of price uncertainty or volatility. However, in fully market oriented production systems, the importance of marketable surplus as a concept becomes less relevant because it is assumed that the producer produces only those commodities that have a market and are profitable, irrespective of whether it is food grain or something else.

So, generally production, consumption, sales and purchases have been considered as elements in defining marketed or marketable surplus. In the smallholder production system in Bangladesh as elsewhere in the developing countries, in addition to sales, transactions and transfers may take place among producers due to rent, in kind wage payment, gift, loan etc. Moreover, due to seasonality of harvest and more continuous consumption needs, significant inventory changes between two seasons or years may occur- output of a season or a year is not fully disposed of within the season or year. Thus the volume of food grain available on a farm over time depends on the volume of incomings due to new harvest, purchases or receipts for other reasons and outgoings due to consumption, sales and payments or giving away for other reasons. In fully commercial production systems or systems in which non-sale transactions and transfers

[3] Some studies in Ethiopia showed that some smallholders sold a larger share of their marketed output immediately after harvest to avoid high rate of post harvest storage losses due to lack of proper and good quality on-farm storage facilities, and bought back later as required (Gebre-Meskel et al., 1998; Bekele, 2003; Gabriel and Hundie, 2005). Whether this reason prompt early sale among Bangladeshi farmers, and if so to what extent, is not known.

and inventory changes is zero or negligible, sales as a percentage of net output is a good measure of marketed surplus or commercial off take rate. However, where non-sale transactions and transfers and inventory changes involve a significant proportion of output, accurate estimation of marketed surplus will require proper treatment of non-sale inter-farm transactions and transfers.

However, the concepts gross marketed surplus, net marketed surplus and marketable surplus have been defined and measured somewhat differently by different empirical researchers, especially the non-sale, non-purchase transactions and transfers have been treated variously – some left them out of consideration for measuring marketed or marketable surplus ratios while others included them one way or another, partly or fully.

Studies conducted in Bangladesh will be reviewed in light of the above definitions highlighting major strengths and weaknesses and their implications. These will be summarized at the end of the paper.

2.2 Evidence on marketed and marketable surplus and marketing trend of rice

One of the earliest studies on rice marketing in the then East Pakistan reported that aggregate marketed surplus of rice[4] in 1964-65 was 10% of net production. Net production was derived by deducting 11% of gross production as seed, feed and waste (Raquibuzzaman, 1966). Ahmed (1979) mentioned that in the mid 1960s, 61% of gross rice output was consumed on farm, 9% accounted for seed, feed or waste and 17% was used for non-market disposal including rent payment, which implies that the remaining 13% was marketed. Ahmed (1981) quoted results of several rounds of Master Surveys of Agriculture which also reported marketed surplus of 10-14% of gross output of rice. At that time, the public sector handled only 4-5 percent of total net supply of rice, which represented 40-50 of total rice entering the marketing channels, the remainder was supplied by the private sector (Farruk, 1970).

Bangladesh Planning Commission reported marketed surplus of 19% of net output in 1973-74. Several other estimates reported marketed surplus for several years during the 1970s and the 1980s (Table 1). It appears that in about 10 years from 1976/77 to 1986/87, marketed surplus increased from 34% to about 42% of net output.

Quasem (1979) estimated marketable surplus of Aman paddy in 1977 based on a sample of 276 farms selected from three villages each in Haluaghat upazila in Mymensingh district and Birganj upazila in Dinajpur district. Two key assumptions in the estimation of marketable surplus was family consumption requirement of rice at the rate of 411 gm/capita/day against FAO recommendation of 397 gms and actual 1973-74 consumption of 354 gms based on Rabbani and Hossain (1978) and seed requirement for aman was 3% of production and wastage was 1% of production. Both the upazilas were surplus paddy growing areas and suppliers of paddy to government procurement programme. Aman accounted for about 70% and Aus 30% of paddy production in the

[4] It seems that in the literature on Bangladesh under review in this paper, the terms rice and paddy have sometimes been used interchangeably.

sample areas and at that time virtually no boro was grown in those areas. Average farm size was 4.78 acres in Haluaghat and 3.25 acres in Birganj – much higher than the national average farm size of around 1.5 acres. Overall, marketable surplus was 57% in Haluaghat and 26% in Birganj with considerable variation among size classes (Table 2). On average, all size groups in both the upazilas except small farms in Birganj had positive marketable surplus. Forty four percent of marketable surplus in Haluaghat was sold during December and January – immediately after the harvest when government procurement programme was active; in Birganj, it was 76%, and in both the upazilas a higher share was sold in December. Proportion of marketable surplus sold in December-January declined as farm size increased.

Table 1 Marketed surplus of rice in Bangladesh, selected years

Year(s)	% rice area under HYV		Rice production (MMT)	Marketed surplus (000MT)	% marketed surplus
	Aman	Total			
1976/77-78/79	6	13	10.8	4250	34
1979/80-81/82	16	21	12.5	4824	36
1982/83-84/85	18	26	13.4	5573	39
1986/87	21	30	14.4	6468	42

Source: for original sources see Dey (1988)

Table 2 Estimated marketable surplus of Aman paddy and marketing pattern by size of farm in Haluaghat and Birganj upazilas, 1977

Upazila	**Small**	**Medium**	**Large**	**All farms**
Marketable surplus				
Haluaghat area	19.4	49.0	68.8	57.2
Birganj area	-20.4	22.1	48.7	26.2
% marketable surplus sold in Haluaghat				
December	65.7	32.3	22.9	26.9
January	11.6	10.1	19.3	17.2
Total in two months	77.2	42.9	42.2	44.0
% marketable surplus sold in Birganj				
December	-40.4	56.2	31.1	49.1
January	-16.1	23.1	19.8	26.6
Total in two months	-56.6	79.3	50.9	75.7
% aman production sold in Haluaghat				
December	19.7	23.5	26.4	24.6
January	3.5	7.2	22.3	15.7
Total in two months	23.2	30.7	48.7	40.4
% aman production sold in Birganj				
December	12.5	18.6	22.5	19.3
January	5.0	6.7	14.3	10.4
Total in two months	17.5	26.3	36.8	29.7

Source: Quasem (1979)

The study did not estimate actual total marketed surplus but estimated share of total aman production sold during December and January, to understand market participation in the government procurement programme. It was found that 40% of aman production in Haluaghat and 30% in Birganj were sold during these two months, and a larger share was sold during the month of December, as in the case of marketable surplus. However, proportion of aman output sold during the two months increased as farm size increased, which was opposite the pattern found in case of proportion of marketable surplus sold. The reason for this difference in pattern was not explained.

A major study conducted by the Bangladesh Rice Research Institute (BRRI) estimated supply and utilization of paddy (as well as wheat) for the period November 1982-October 1983 based on a stratified random sample of 2000 farms from six zones defined for the study based on agroecological environment and surplus/deficit production situation (Islam et al., 1987). The size distribution of the sample was not shown but the average rice crop per sample farm was 4.74 acres (taking all three rice crops together), which indicates that the sample might be slightly biased towards larger farms. Separate production and disposal data for each of the three rice crops as well as for the three crops together were shown in the study report. Over all supply and utilization figures per farm for all three rice crops are shown in column 2 of Table 3. Although the range of data presented are one of the most comprehensive farm level data on rice production and disposal including quantities sold and purchased, surprisingly nowhere in the report one finds any reference or measure of marketed or marketable surplus ratios.

However, the detailed production, transaction and disposal data provided by Islam et al indicate that there were conceptual or methodological problems in using conventional definitions of marketed and marketable surplus in the given context. In order to illustrate these complexities, marketed surplus ratios were estimated in two ways using data from Table 3 and presented in columns 3 and 4 of the table. The implications of these are discussed below.

First, for the sample average farm, production accounted for 83% of total supply of rice during the year, the remaining 17% was incoming due to purchases and receipts from others[5]. Looked differently, supply was 121% of production and it was the supply rather than the production alone that in theory provided the basis for utilization including sales.

Second, gross marketed surplus ratio could be estimated as percentage of production or percentage of available output (production + receipts) or total supply (assuming purchased paddy could also be sold along with own output). In column 3 it is shown that gross marketed surplus would be 25.1% if calculated as a percentage of total production and net marketed surplus i.e., sales minus purchase as a share of production would be only 6.3%. But if the base was availability or supply rather than production, gross and net marketed surplus would be lower. In reality supply or availability would be better alternatives than production as a base to calculate marketed surplus because in theory

[5] Perhaps as rent of share cropped land, wage payment, loan repayment or gift but no such details were explicitly mentioned in the original report

sales took place out of the total available or total supply, not just from gross or net production.

Table 3 Overall supply and utilization of paddy per farm, 1982-83 crop season (maunds)

	Total 3 seasons (maunds)	% of gross output*	% of supply*
Supply			
Production	87.9	100.0	82.8
Purchase- Paddy	8.3	9.4	7.8
-Rice in paddy equivalent (PE)	8.2	9.3	7.8
Received from others -Paddy	1.6	1.8	1.5
-Rice (PE)	0.1	0.1	0.1
Total supply	**106.1**	120.7	100.0
Utilization			
Sales -Paddy	20.7		
-Rice (PE)	1.0		
-Seeds	0.4		
Total sales (marketed surplus)	**22.1**	25.1	20.8
(Net sales = Sales – Purchase)	**(5.6)**	(6.3)	(5.3)
Given to others -Paddy	1.9		
-Rice (PE)	0.1		
-Wage in paddy	3.3		
Total given out	**5.3**	6.0	5.0
Loss in storage	**1.0**	1.1	0.9
Total outgoing	**28.4**	32.2	26.7
Consumed - Paddy	58.4		
-Rice (PE)	13.1		
-Used as seed	3.8		
Total consumed	**75.3**	85.7	71.0
Total utilized	**103.7**	118.0	97.7
Balance (closing stock)	2.4	2.7	2.3
Total disposal	**106.1**	120.7	100.0
Stored	81.6	92.8	76.9

* Figures in these columns were not shown in the original report or table. They have been derived by the author of this paper to discuss their implications (see below).
Source: Islam et al. (1987)

Third, sales bring cash but non-sale outgoings also have opportunity cost- cash that could be derived if the amount disbursed in kind was sold. Therefore, a question is whether only sales or sales plus other outgoings should be considered for estimating marketed surplus ratios. Similarly, whether in estimating net marketed surplus ratio, only purchases or purchase plus all other incomings should be deducted from total availability is also a question.

Fourth, non-sale outgoing was about 5.0% of total utilization while non-purchase incoming was only 1.6% of total supply. Therefore non-sale transactions did not cancel out each other, as some of these transactions possibly took place with non-producing households such as landless, which might not have been adequately included in the sample.[6] Such imbalances also make accurate estimation of marketed surplus from sample data, especially when the sample may not truly represent population characteristics, problematic.

Fifth, seed (own use plus sales) and wastage in storage accounted for only 4.8% of total production but 4.0% of total supply or disposal. This was quite low compared to the 9-11% rate generally assumed and used in estimating net output for consumption and marketing. This raises the question if all or most farmers use own seeds and if there is really a justification for deducting 9-11% of gross output as seed, feed and waste to calculate net output (more on this in another study reviewed below). Moreover, some seeds were sold and some were purchased, so seed appeared to be a tradable commodity. Hence, bundling seeds with feed and waste and using a fixed rate of deduction to estimate net output also appeared questionable.

Sixth, closing stock accounted for 2.7% of production or 2.3% of supply but no opening stock was recorded, which probably was due to non-collection of opening stock data. Moreover, 93% of production or 77% of supply was stored by the sample households for a few days to several months during the year. This was operating stock for consumption and other disposal as they occurred over time. So the quantities available for consumption, sale or other forms of disposal did not remain static rather it changed over time due to incomings and outgoings including sales and purchases. Sales and purchase patterns by month for the sample as a whole are summarized in Table 4. It appears that some proportion of farms sold paddy throughout the year though the highest proportion of farms sold during May-July, when boro was the main harvested crop. Similarly some proportion of farms purchased paddy throughout the year and lowest proportion purchased in June-August. Over 50% of the sample households did not buy or sell paddy during the survey year; they were perhaps autarkic. Non-participation was lowest at 38% in June and highest at 62% in February, and the modal value was about 55%.

Distribution of yearly sales and purchase volumes showed that they were more or less evenly distributed over the year, which means that surplus producers sold intermittently throughout the year and deficit producers bought intermittently throughout the year.

These problems underlie methodological complexities in the context of smallholder production system in which production is not the only source of supply, and consumption and sales are not the only forms of disposal. These data point to the need for systematic recording of opening and closing stocks along with increasing farm stock due to harvest and other receipts and depleting farm stock due to consumption, sales and other transactions and transfers in order to get accurate measurement of marketed surplus.

[6] Such imbalance can occur for the individual household or a sample if it is not representative of the population. In reality, for a representative sample or in the aggregate the volume given out and received under non-sale transactions would be equal., as the volume sold and purchased would be also equal.

Table 4 Paddy buying and selling pattern among the sample farms, 1982-83 crop season

Month	% farms selling	% yearly total sales	% farms buying	% yearly total buys	% farms not buying or selling
November 82	19	7.2	21	7.7	60
December	25	11.0	22	7.6	53
January 83	24	9.6	15	8.3	53
February	28	6.8	10	9.5	62
March	27	7.0	12	8.6	61
April	20	9.3	20	8.2	60
May	36	7.6	26	9.0	38
June	43	9.2	9	9.9	55
July	34	9.4	11	6.7	55
August	30	7.0	15	7.7	55
September	23	8.1	23	8.7	54
October	20	7.8	24	8.0	56

Source: Islam et al. (1987)

The same data set was used by Akter (1989) who estimated marketable and marketed surplus of paddy on the basis of 1976 households out of the original 2000 samples due to data limitations in some cases. She defined marketable surplus as the quantity available for marketing which was equal to household net output (gross output less rent paid and seed, feed and wastage) minus consumption, and marketed surplus as the net quantity marketed which was equal to gross sales minus gross purchases. She showed estimated quantities of marketable and marketed surplus per adult unit for the sample households (Table 5) instead of per household shown by Islam et al. She also did not calculate the marketed and marketable surplus ratios for which no explanation was also given.

Gross marketed surplus (sales) as share of production would be 22.8% and net marketed surplus (sales minus purchase) as share of production would be 5.3%. As a share of available supply (production plus receipts), gross and net marketed surplus would be respectively 22.4% and 5.2%. If marketable surplus was calculated as a share of production, it would be 16.8% and as a share of available supply it would be 16.5%. Thus gross marketed surplus was higher than marketable surplus and this was compensated by purchase. Marketable surplus amount was almost equal to the amount purchased. One last caveat in the data is that a figure for ‘net change of stock’ was shown in the table to close the utilization account, but the figure actually was closing stock as the residual, without a corresponding opening stock.

Table 5 Marketable and marketed surplus of paddy per adult unit in 1982-83 crop season

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Characteristics	Mean (kg/adult unit)
Production (excluding net rent paid)	513
Receipts in kind	9
Gross purchases	90
Consumption	400
Payments in kind to labour	16
Other in kind payments	12
Gross sales	117
Seed used	21
Seed sold	1
Storage loss	5
Net change in stock	40
Marketable surplus	86
Marketed surplus (net)	27

Source: Akter (1989)

Quasem (1987) reported estimated marketed surplus based on a sample of 496 farms surveyed in 16 villages in different parts of the country in 1982. He defined gross marketed surplus as sales as a ratio of total production, which included own production plus rent received for sharecropped or mortgaged land. No adjustment was made for 'seed, feed, wastage'. Goss marketed surplus was 28% for the year and 24, 18 and 43% respectively for aus, aman and boro paddy production. By farm size, gross marketed surplus was 26, 30 and 26% for small, medium and large farms respectively. Net marketed surplus was defined as gross marketed surplus minus buy back and it was 11% overall and -9, 21 and 22% respectively for small, medium and large farms.

Overall 39% of total sales occurred at 'harvest time' – 50% for small, 41% for medium and 22% for large farms. Share of yearly sales in each quarter of the year was as follows: first quarter 23%, second quarter 32%, third quarter 25% and fourth quarter 20%.

The main concern about the results of this study is that gross marketed surplus ratios were almost similar for the three farm size groups- in fact the highest ratio was for medium farms, and net marketed surplus ratios of medium and large farms were about the same. This would be normally unexpected as the author has shown in the paper that the size distribution of the sample was not too far from the national level size distribution, so much higher marketed surplus for larger farms would be normally expected. This raises the question on whether outputs were adequately and properly measured and whether exclusion of non-sale and non-purchase transfers and transactions including non-adjustment of any amount due to 'seed, feed, wastage' rendered the estimated output and marketed surplus ratios – both gross and net- inaccurate.[7] To the extent these transfers

[7] This was evident in the disposal pattern of the sample reported by Islam et al. (1987) discussed earlier

and transactions affect different size groups differently, their exclusion might have distorted the estimated marketed surplus ratios differently.

Record on quarterly sales on its own was not very meaningful without reference to the particular rice crop sold in a given quarter. It was more likely that sales of a particular rice crop spilled into the production-marketing period of another rice crop, so in a quarter more than one type of rice was sold. The data on 'harvest time' sales also could not be interpreted easily because the meaning of 'harvest time' was not clearly defined. Since harvest time itself might be spread over several weeks and with threshing, the spread might be even longer, a clear definition of harvest time would make the data more meaningful.

Murshed and Rahman (1988) estimated marketed surplus for 1986/87 crop season based on a sample of 222 randomly selected farms in eight districts. Eighty small, 70 medium and 72 large farms were selected. Since the distribution of the sample was not proportionate to the population, only size specific results were presented without presenting an overall average as that would be unrepresentative or biased.

Marketed surplus was defined as "gross quantity of produce actually sold by the farmers", and production included output from own and mortgaged in land and half of the output from rented in and rented out land. No adjustment was made for 'seed, feed, wastage'. Estimated marketed surpluses by size of farm are shown in Table 6. Marketed surplus as a share of production turned out to be 26, 28 and 36% for small, medium and large farms respectively. Net marketed surplus was not defined or calculated but with respect to small farms it has been stated that " … the balance was negative, viz, marketed surplus and family consumption together exceeded production. This indicates the prevalence of distress sale among farmers belonging to the small size group".

Table 6 Annual average production, consumption and marketed surplus of paddy per farm according to farm type (metric tons)

Farm type	Production	Consumption	Marketed surplus
Small	2.43	2.14	0.64
Medium	4.60	3.06	1.29
Large	11.03	4.51	3.93

Source: Murshed and Rahman (1988)

The main caveat in the methodology and the results presented was that if marketed surplus was equal to quantity actually sold, as defined, then consumption was a residual after sales since production was shown in the table as equal to consumption plus marketed surplus. But consumption in that case was actual consumption as no other transfers or transactions were recognized or recorded, not even purchases as a source of consumption, or disposal due to seed, feed and wastage, and no assumptions were made regarding such transfers and transactions. This was unrealistic in the Bangladesh context as several other studies recorded incomings and outgoings in various forms including sales and purchases. The authors stated that sales plus consumption exceeded production

for small farmers, which was an indirect recognition that such farmers indeed had incomings in some form to balance the equation or fill the deficit. Even though in theory, in the aggregate, such inter-farm transfers might cancel out, for a given sample, especially if it did not resemble actual population distribution, as in the present case, non-consideration of non-sale and non-purchase transfers and transactions would distort the estimates for marketed surplus to some extent.

Chowdhury (1992) presented marketed surplus ratios for 1989-90 crop year based on a survey by IFPRI on a sample of farms from 11 progressive districts and 9 non-progressive districts classified on the basis of technology used and surplus/deficit status in rice production. He estimated marketed surplus as sales as a percentage of net output and presented ratios separately for aman and boro seasons and for the two seasons combined according to farm size and type of sample district (Table 7 and 8). However, there are problems in his data, results as well as interpretation of results.

Table 7 Production and marketing regimes per farm for aman season in 1989/90 by farm size and type of district

District type and Farm type	N of sample	Own land (acres)	Operated land in aman season (acres)	% under HYV	Net output (mds)	% net output marketed
Progressive						
Small	94	1.3	1.7	39	46	42
Medium	162	3.7	3.1	41	94	46
Large	186	9.9	5.3	37	196	57
All	442	5.8	3.7	39	127	53
Non-progressive						
Small	71	1.4	1.6	47	36	39
Medium	94	3.7	2.9	47	73	40
Large	72	8.9	4.7	35	143	49
All	237	4.6	3.0	45	83	42
Overall	**679**	**5.4**	**3.5**	**41**	**112**	**49***

* On pages 64-65, Chowdhury reported that the overall marketed surplus ratio for the crop year 1989-90 was 49%. This was perhaps reported by mistake because aman season ratio was 49% and boro season ratio was 82% (see table 6 below), so overall marketed surplus could not be 49%.

Source: Chowdhury (1992) Table A1.1, p.106

First, overall marketed surplus in the aman season was 49% and the ratio increased along with farm size but the differences between progressive and non-progressive districts were not very large. Overall marketed surplus ratio in the boro season was 82%, which appeared really very high. Like the aman season, the ratio increased with farm size. However, in table 8, the closing stock of aman season has been shown along with boro season data but neither opening nor closing stock has been shown for the aman season in Table 7 even though elsewhere in his report, he mentioned that ‘ the ratio of the carry in

to the aman harvest stands at 6%'[8] (Chowdhry, 1992, p67). He also mentioned that carry out for the year was 4 kg per person compared to 1.5 kg a year ago (p.67). Because of such large volume of inventories by season or year, it can be reasonably assumed that sales in a season occurred not just from current net output but also from carry over stocks from the previous season. Yet gross seasonal marketed surplus has been estimated as sales as a percentage of only current net output of the relevant crop season. Since inventory change and other transactions and transfers may not always cancel each other in small samples, especially if the sample is not representative of the national size distribution, as in the present case, exclusion of inventory changes and other transactions have rendered estimated marketed surplus in this study inaccurate.[9]

Table 8 Production and marketing regimes per farm for boro season in 1989/90 by farm size and type of district

Farm type	Closing stock of aman season, mds	Operated land in boro season (acres)	% under HYV	Net output (mds)	% net output marketed
Progressive districts					
Small	16	1.3	81	47	60
Medium	41	2.1	91	95	80
Large	85	4.0	98	198	92
All	49	2.7	85	128	86
Non-progressive districts					
Small	11	1.3	55	46	53
Medium	26	2.4	69	80	75
Large	63	4.1	53	154	84
All	na	2.6	na	92	76
Overall	**42**	**2.7**	**77**	**116**	**82**

Source: Chowdhury (1992), Table A1.2, p107

Second, it appears as though inadvertently Chowdhury recognized the relevance of inventory changes in measuring marketed surplus while discussing measurement of private stocks later in the document, and presented two new measures of marketed surplus: gross marketed surplus as a percentage of output (not net output) and gross marketed surplus as a percentage of availability where "availability is equal to carry in from past production plus **net size** of the harvest at the onset of the current market season" (p.219).[10] The estimates are presented in Table 9. The new estimates showed that when marketed surplus was estimated as a percentage of available supply rather than net

[8] It was not clear if it was 6% of aman harvest or any other base.
[9] This was evident in the disposal pattern of the sample reported by Islam et al (1987) discussed earlier.
[10] There was still confusion about the appropriate base to be considered as he used gross output in one case and net output and availability in another without explaining the rationale behind the alternatives.

output, the ratio came down from 49 to 32% in the aman season and from 82 to 48% in the boro season. However, the author did not explain the logic behind the two separate procedures and estimates and did not clarify which estimate was more appropriate.

Table 9 Marketed surplus of rice taking into account private stocks, 1989-90

	Aman season	Boro/aus season	All seasons
Opening stock, 000 mt	660	2660	-
Rice production, 000 mt	8274	7667	15941
Gross marketed surplus, 000 mt	2853	4935	7788
GMS as % of output	34	64	49
GMS as % of availability	32	48	47
Closing stock, 000 mt	2660	1140	-

- no data provided and no explanation provided

Source: Chowdhury (1992), p219

Third, the sample distribution by size shows that sample selection was biased towards medium and larger holdings, and it did not resemble the national size distribution as few landless and smallholders were sampled. The conceptual confusion and accounting problems in the estimation procedures for the marketed surplus ratios, along with sample bias, might have resulted in the relatively high marketed surplus ratios, especially in the first set of estimates. The second set that was based on availability rather than net output was conceptually more accurate and the numbers also appeared more realistic, if not fully accurate.

Chowdhury argued that his estimates were more robust and accurate than Murshed and Rahman because of the larger sample size from a larger number of districts covered by the IFPRI survey and because of the buoyant rice production situation in 1989-90 (p.65-66). However, there were methodological pitfall of his estimates as discussed above which definitely rendered those advantages partly ineffective in generating accurate estimates for marketed surplus irrespective of whether Murshed and Rahman's estimates were accurate or not.

Alam and Afruz (2002) estimated marketed and marketable surpluses for aus, aman and boro seasons for the period March 2001 to April 2002 based on a random sample of 180 households from Chandina upazila in Comilla district and Ishawrganj upazila in Mymensingh district. They defined marketable surplus as total production minus total family requirements (family consumption, farm seeds, kind payment to labour, gifts for social and religious purposes, and storage losses) as percentage of total production and net marketed surplus as gross sales minus buy back as percentage of total production. Some key results of the study are summarized in Table 10. However, narrative in the paper and close examination of the results show that the estimated ratios were questionable due to some conceptual problems and the estimation procedures applied.

Table 10 Estimated marketable and marketed surplus of aus, aman and boro paddy in Chandina and Ishwarganj upazilas, 2001-2002

	Aus	Aman	Boro
Disposal of total production	%	%	%
Consumption	44.1	31.6	28.8
Debt payment in kind	2.8	3.3	2.1
Wage payment in kind	4.2	15.8	3.5
Donation and jakat	1.8	3.4	2.7
Seed use	4.0	4.7	8.9
Storage loss	1.8	1.3	1.0
Marketable surplus	**41.2**	**50.0**	**60.5**
Total	100.0	100.0	100.0
Marketed surplus	**38.3**	**48.3**	**57.5**
Of total sales :			
Pre-harvest sales	26.4	35.3	27.9
Harvest time sales	43.4	52.9	62.1
Sales at other times during the year	30.2	11.8	10.0

Source: Alam and Afruz (2002), Tables 5 and 7.

First, the estimated marketable surpluses for all three rice crops were higher than marketed surplus, which implied that the sample producers did not sell as much as they could. This was an unexpected result, albeit an inconsistent result, unless the unsold paddy was actually consumed in addition to the volume already shown as consumed. A closer look however indicates that there was a confusion or an inconsistency about the procedure for estimation of marketed surplus. In the text, it has been defined as gross sales minus buy back as a percentage of total production (not net production) but in table 5 of the paper, it has been calculated as marketable surplus minus buy back as percentage of total production. Again volume of total sales shown in Table 7 of the paper did not match the volume of marketed surplus shown in Table 5. Therefore neither the estimated marketable surplus nor the marketed surplus could be considered as accurate.

Second, total sales were shown for three periods – pre-harvest time, harvest time and other times during the year. Normally rice would not be sold before harvest except in a few cases where poor producers might have borrowed on condition of paying back in kind in terms of harvested paddy, which could be considered as pre-harvest sale, but such transactions were supposedly included in the category called 'debt payments'. Moreover, the volume of such transactions could not be as much as 26-35% of total sales as reported in this study. The most plausible explanation of pre-harvest sale was that for each crop season, there was carry over stock from the previous rice crop, which was sold before harvest of the next crop, e.g. some portion of aus was sold just before the next aman harvest, so it was end of season sale of the aus crop and not the pre-harvest sale of the aman crop. The authors probably failed to record properly the sales of different rice crops according to time of sale, hence this confusion. However, the fact that they have shown pre-harvest sale, even if with improper connotation, they have inadvertently shown that every crop season had opening and closing stocks, which spilled into the next crop season for disposal along with the current season production one way or another, whether

through consumption or through sale. As mentioned earlier, this information once again highlighted the need for inclusion of inventory changes in the equation for estimation of marketed surplus in an accurate way.[11]

Bayes and Hossain (2007) studied changes in resources and livelihoods of a panel of nearly 2000 households in 62 villages in 57 districts for 1988, 2000 and 2004. As a part of that study, they reported that marketed surplus of paddy defined as sales as percent of net output increased from about 38% of output in 1987/88 to 43% in 1999/2000 and 41% in 2003/04. Of the total sales, respectively 31, 31 and 42% was sold within the first month of harvest in 1987/88, 1999/00 and 2003/04. Separate figures for different rice crops were not shown so it was unclear if the ratios were the same for all three rice crops.

More detailed results have been shown for 2003/04 (Table 11). Overall 52% of farms sold some paddy during the year and 48% did not buy or sell. Islam et al (1987) found that in 1982-83 season, non-participation was lowest at 38% in June and highest at 62% in February, and the modal value was about 55%. So non-participation has decreased only slightly in 2003/04.

When surplus/deficit status of a household was considered taking into account family consumption needs, the sample as a whole had a net surplus of only 4% of their aggregate production for the market outside the sample. As farm size or economic status increased, the extent or proportion of surplus output after meeting consumption needs increased, proportion of farms who sold output increased and the share of net output sold also increased. On the other hand, farm size or economic status had an inverse relationship with the proportion of sold output that was sold within the first month after harvest, which the authors termed as 'distress sales'. Only about 2% of the sample farms operated over 2 ha of land and they produced 16.5% of net output, they had 77% of their output as surplus, which they sold. On the other hand, 31% of the sample farms had farm size up to 0.4 ha and they produced only 18% of net output but they had 42% deficit to meet their consumption needs yet 36% of this group sold paddy amounting to 15% of the group net output and two third of their sales was done within the first month after harvest.

Similar pattern was observed when farms were classified by economic status (Table 9). Only 15% of the farmers were rich and they produced 38% of net output and had 47% of their output as surplus. Seventy six percent of this group sold paddy amounting to 61% of the group net output. Overall, this group supplied 92% of the volume of surplus paddy entering the market. On the other hand, poor households had a deficit of 61% of their

[11] Wright (2009) in analyzing role of international grain reserves in addressing volatility in grain markets emphasized that in any period regardless of economic setting (monopoly, competition, oligopoly) two accounting relations hold: available supply for the period is the sum of the harvest and stocks carried in from the previous period, and consumption during the period is the difference between available supply and the stocks carried forward to the next period. Therefore, estimation of marketed surplus without taking into account inventory changes, whether at individual household or at national or international level, is bound to be erroneous.

needs yet 38% of the group sold paddy amounting to 24% of group net output and 61% of the sales volume occurred within the first month of harvest.

Table 11 Market participation and marketed surplus of paddy in 2003/04

Farm characteristics	% farms	% net output	% output surplus/ deficit (-)	% farms sold	% of output sold	% of sale within the first month
Farm size (hectare)						
Landless	38.6	0.2	-95	-	-	-
Up to 0.40	31.0	18.2	-42	36	15	65
0.41 – 1.00	20.7	36.3	32	67	28	59
1.01 – 2.00	8.0	28.9	50	89	56	40
Over 2.00	1.9	16.5	77	94	78	27
Economic status+						
Ultra poor	9.3	0.8	-90	-	-	-
Poor	28.7	10.2	-61	38	24	61*
Small/vulnerable	47.3	51.2	0.6	58	33	49
Rich	14.7	37.8	47	76	61	34*
All farms	100.0	100.0	4	52	41	42

- not available

+ Definitions of these terms or groups are not available in the text.

* In the text, the authors wrote " …probably, somewhat unexpectedly, rich households sold two third of the sold amount within the first month of harvest. Small/vulnerable households sold 49% and poor households sold 34%" p.263. But it can't be true if the upper part of the column is correct, which shows an inverse relationship between % sale within first moth and farm size. Most likely this is a typing error; in reality the ratio for the poor is 61% and for the rich 34%.

Source: Bayes ad Hossain (2007), p.279 and 283.

Since information on opening and closing inventories and transfers and transactions other than sales and consumption were not shown, and apparently no adjustments were made for seed, feed and wastage, accuracy of the marketed surplus ratios mentioned above remain suspect for reasons discussed earlier.

3 Review of evidence on private stocks

3.1 Changing practices and functions of private stocks

Private stocking practices in the country have undergone a major change because of two main reasons- changes in the rice production technology and relative importance of different rice crops, and changes in the rice processing technology and its functions.

Until the late 1960s, aman was the principal rice crop with aus a distant second while boro was a minor localized crop in some parts of the country. Typical on-farm storage period for aman rice for own consumption was up to eight months following harvest in November-December (Farruk, 1970). Where aus and/or boro was/were also important, the storage duration for each rice crop was shorter. Since the late 1960s, a significant change has occurred in the relative importance of aman, aus and boro rice output along with increase in overall rice output in the country. After the introduction of irrigated high yielding boro rice production, cropping patterns started changing- the boro and aus seasons gradually became overlapped and irrigated boro replaced traditional aus in some places and over time boro became a more important crop than aman pushing aus to the third position. Introduction of improved varieties in the aman season also contributed to the shift in the relative shares of the three rice crops. The consequence of these changes was that flow of output became more evenly distributed throughout the year compared to the skewed distribution in the past. A more even distribution also reduced the period of on-farm storage needs.

Until the late 1960s, or even up to mid 1970s, home pounding with dheki accounted for 64-77% of paddy processing, small rural huller mills accounted for 17-30% and medium and large commercial rice mills accounted for 2-6% of rice processing in the country (Harris, 1979, quoting various sources). While rural huller mills provided custom processing services to farmers, so stocking paddy was not required for them, large and some medium commercial mills were primarily engaged in own processing business which required procurement and stocking of paddy as well as rice. Some of these mills also provided custom processing services to the government to assist its food grain distribution function, which also required stocking for different durations. The commercial rice mills were located in rice surplus districts where government procurement programme was concentrated. In 1968-69, 50% of the large commercial rice mills were located in (old) Dinajpur district alone and another 40% were located in (old) Rajshahi, Rangpur and Bogra districts. The small and medium huller mills were more widely distributed throughout the country though some districts like Chittagong had a higher concentration compared to other districts (Farruk, 1970). Over time, with increased output and increased marketed surplus more or less throughout the country, a change in the rice processing technology has also occurred. Home pounding has virtually disappeared, large numbers of small huller mills serve custom processing needs in rural areas but the number of medium and large commercial mills has increased rapidly and they have become involved in rice processing business. Licensed rice mills also play key role in the government procurement programme as government purchase paddy through or from millers. So stocking has become an important ingredient of the rice milling

business. Distribution of large scale rice mills are shown in Table 12. Dhaka, Chittagong, Khulna and Dinajpur still dominate the share of these mills. Small and medium sized mills have a more even distribution throughout the country.

Table 12: Distribution of large rice mills by district , 2002

District (old)	Number of mills	%
Dhaka	69	19.5
Chittagong	52	14.7
Khulna	47	13.3
Dinajpur	44	12.5
Sylhet	29	8.2
Noakhali	28	7.9
Mymensingh	10	2.8
Bogra	13	2.8
Comilla	6	1.7
Rangpur	6	1.7
Faridpur	5	1.4
Rajshahi	4	1.1
Barisal	5	1.4
Jamalpur	3	0.8
Patuakhali	2	0.6
Total	353	100.0

Source: BBS, 2002, p.152

3.2 Evidence on volume and pattern of private stocks

One of the earliest attempts to estimate private stock of rice by farmers and traders was made by Farruk (1970). Since he did not collect primary data on stocks from producers and market agents, he estimated an aggregate level month end stock for the period 1959-60 to 1967-68 as a residual of the difference between a putative consumption norm per person per month and monthly appearance of output from domestic production, i.e.,

Inventory at the end of month m = (opening stock at the beginning of the month
+ net harvest during the month)
– consumption during the month.

The estimates were made on the basis of the following assumptions:

- Aus harvest - 10% in June, 20% in July, 70% in August
- Aman harvest – 30% in November, 60% in December, 10% in January
- Boro harvest – 10% in March, 70% in April and 20% in May
- 89% of gross output was used for effective consumption, remaining 11% was used on-farm for non-human consumption needs such as ‘feed, seed and waste’.
- Per capita consumption was 0.16 tons per year or 0.438 kg per day

Of the estimated total private stocks, information on farm vs trader stocks was not shown. Also no explicit assumption was made about base population and monthly or yearly growth rate of population though it is obvious that some estimates were used. His estimated month end stocks showed negative figures for several months in most of the years. Chowdhury (1993) noted that Farruk's estimated negative stocks in lean months might be equated with drawdown of rice stocks from public distribution system. However, Farruk also showed public sector share in monthly marketed rice elsewhere in his study but the estimated negative stocks did not appear to match those numbers.

Islam et al. (1987) found in their survey of 2000 farms in 1982-83 that 76.9% of supply (92.8% of production) was stored for varying length of time, from a few days up to several months, which implied that farmers had working or operating stocks mainly for consumption. The study report did not show monthly consumption and closing stocks but showed only monthly sales.

Chowdhury (1992), after reviewing the literature on marketing and recognizing the gap in terms of estimation of private stocks of food grain, attempted to fill the gap arguing that 'virtually any worthwhile discourse on price policy begs the question on the level of private stocks'. He estimated private stock of rice, in addition to other aspects of rice marketing, based on a survey of farms and market agents by IFPRI in 1989-90. The farm sample distribution had a bias towards medium and larger holdings as discussed earlier.

He stated that for a household the following identity should hold (when all quantities are derived from production alone):

$$I_t - It_{+1} + Q_t = X_t + M_t$$

where Q is quantity harvested, M is quantity marketed, X is quantity consumed, I_t is carry in stock and It_{+1} is carry out stock, and t is a seasonal subscript. Simply put, he assumed that 'what is neither consumed nor sold has to be stored across seasons or market periods'. So viewed the stored or stocked amount is represented by It_{+1} i.e,

$$I_t + Q_t - (X_t + M_t) = I_{t+1}$$

He further stated that "this accounting identity was implemented in quantity terms, which established an warrant for treating all rice/paddy receipts (whether purchases or received in public rationing or other food distribution schemes or in lieu of work performed) as additive. All estimates of farm stocks should be seen as relative to farm production, and net of purchases or transfers or kind-receipts" (p.214). Sample average estimates were blown up to get aggregate national level farm stocks under a set of assumptions. The estimated month end farm stocks for October 1989 to October 1990 are shown in Table 13 where trader and public stocks are also shown.

Table 13 Economy-wide end of month rice stocks (million metric tons), 1989-90

Month	Farm stocks	Trader stocks	Total private stocks	Public stocks	Total stocks	Private stocks as multiple of rice consumption
October89	0.35	0.31	0.66	0.59	1.25	0.47
November	5.22	1.25	6.47	0.66	7.13	4.57
December	5.28	1.83	7.11	0.77	7.88	5.02
January90	4.22	1.84	6.06	0.83	6.89	4.28
February	3.17	1.45	4.62	0.79	5.41	3.26
March	2.20	0.46	2.66	0.70	3.36	1.88
April	2.81	0.86	3.67	0.65	4.32	2.59
May	4.15	1.47	5.62	0.74	6.36	3.97
June	3.16	1.48	4.64	0.84	5.48	3.28
July	2.48	1.15	3.63	0.81	4.44	2.56
August	2.85	0.74	3.59	0.72	4.31	2.53
September	1.92	0.52	2.44	0.59	3.03	1.72
October	0.93	0.21	1.14	0.54	1.78	0.80
Cumulative total	38.74	13.57	52.31	9.23	61.64	
Average/month	2.98	1.04	4.02	0.71	4.74	
% of total stocks	62.9	21.9	84.8	15.2	100.0	

Note: Last three rows in the table are not shown in the original table in the report, they are worked out here to show inconsistency with the text as described below.

Source: Chowdhury (1992), p.221

The key finding of this exercise with respect to private stocks have been stated as follows: "for the year as a whole private stocks amounted to 79% of total stocks" (p.223) implying that 21% was public stocks. Further, 'farm stocks account for 79% of private stocks during the aman season and some 78% during the boro season. (p.223). Thus farm stocks accounted for 62% of total stocks during the year and the remaining 17% lied with the traders. Monthly average private stocks amounted to an average of three months' rice consumption in the country as a whole, though only in October the ratio was lower than that and it was better in 1990 October compared to 1989 October due to a better harvest in 1990. The study found that compared to the 1960s, traders practiced quick turnover and shorter storage period in the early 1990s. Moreover, private stocks, especially farm stocks, played a bigger role in the determination of price, and public stocks displaced traders' stocks through non-farm stocks (Chowdhury 1992, 1993).

However, the actual arithmetic of the farm and trader level stocks still remained a bit fuzzy because of three main reasons. First, the numbers shown in Table 12 do not tally with the above narrative. Based on the figures in the table, private, trader and public stocks accounted for 85%, 23% and 15% of total stock of rice instead of respectively 79%, 17% and 21% mentioned in the text. The reasons for these apparent discrepancies are unclear. Second, the statement "all estimates of farm stocks should be seen as relative to farm production, and net of purchases or transfers or kind-receipts" did not clearly convey how in reality transactions like 'purchase, transfers and receipts' were treated

within the equation. Like incomings, most likely there were outgoings in addition to sales, and it was not clear how those transactions were treated. Third, there was no clear explanation in the report on how monthly trader stocks were actually derived or estimated. There was no detailed information on monthly pattern of sales, purchases and other transactions by farmers as well as traders. The accuracy of the month end stock at both farmer and trader levels would very much depend on how these parameters were treated.

In the early 1990s, after food market liberalization and larger involvement of private traders in rice imports, occasions arose when there were concerns about the socially desirable level of rice stocks in the country – private and public- due to variation in rice production, especially due to climatic reasons. In such circumstances, knowledge about detailed statistics on private –farm and non-farm- stocks of rice were necessary for proper management of the level of public stocks. It is generally known that well planned and executed rapid appraisal can provide fairly reliable information when time and resources may not permit more systematic studies. Based on this principle, a series of rapid rural appraisals (RRAs) were conducted in 1993 and 1994 for assessment of private stocks.

The first one was conducted during October-December of 1993 to estimate stock levels in June 1992 and June 1993 based on a sample of 884 farms in 16 new districts and 412 millers in 13 of those 16 districts[12] (Ahsan et al., 1994). The third one was conducted in June 1994 to assess stock level in mid June 1994 and compare that with the previous estimate for June 1993 based a sample of 403 farms and 171 traders in 10 districts.[13] (Amin and Farid,1994). Both the RRAs used similar approaches and stated that districts were classified into surplus and deficit ones and "as would be befitting for a stocks survey, districts generating rice surpluses were over sampled, as were medium and larger farms within each district". Similarly, millers were divided into those establishments who had a 'mill gate contract' and those that did not and samples were drawn separately. Average farm stock was blown up by corresponding weights (i.e., total number of farms nationally) to yield aggregate farm stocks. For millers and traders, average stocks for each type were blown up by their respective total numbers to get aggregate trader stocks.

The key findings of the first RRA were that (a) in the year to October 1993, private rice stocks at both farm and trader levels had declined compared to 1992, (b) the largest proportionate decrease occurred in case of the mills that had mill-gate purchase contracts in 1992, (c) between 1989/90 to 1992/93, the capacity of the rice markets to meet consumption demand had remained virtually unchanged. The key finding of the third

[12] However, distribution of the farm and trader samples has been shown over 10 districts (Ahsan et al., 1994, p.11). The reason for this discrepancy between the text and the data table was not explained in the report. The plausible explanation is that the 16 new districts belonged to 10 old districts for which data were reported but if that was the case the information should have been presented consistently throughout the report. The third RRA report did not show its sample distribution by district at all.

[13] The second RRA was apparently conducted during the first fortnight of January 1994 but its outcome was not available for this review. Amin and Farid (1994) reported that the first RRA had a sample of 1076 farms and 423 traders. These numbers are much larger than what Ahsan et al (1994) had mentioned in their report. The reason for this difference in numbers between the two reports is unclear.

RRA was that the farm stocks in mid June 1994 was about 5% lower than the previous June and trader stocks fell by 24% between the same periods. Overall private stocks fell by 10% in June 1994 compared to a year before. Both reports provided some explanation about the plausibility of their findings. The authors of the third report cautioned that their smaller sample size compared to the first RRA implied that much greater sample variance might be expected in their estimates.

However, the main concern about these RRAs is that the assertions about the accuracy of the key findings and results were not matched by the necessary degree of details of the methodology used in collecting data and deriving estimates. Few details were given in the reports other than the sample size and general approach to get aggregate figures. Some of the caveats and problems with the methodology are as follows.

First, there were very little details in the RRA reports about the team composition (number of members who conducted the RRAs), how they distributed the work among themselves, the mode of conducting interviews or collecting data – whether individually or as sub-teams, and the actual number of work days employed to cover the samples spread over several districts. It would have been better to provide such information in details given the large size of the sample spread over wide geographical areas.[14]

Second, both the RRA reports showed not only the mid year levels of stocks, which were the stated objectives, but also estimated month end stocks for 13 months (October to October) for the reference year and compared those with the monthly stocks for 1989/90 reported by Chowdhury (1992). Yet neither RRA report provided any details of what data, parameters and assumptions were used in deriving those monthly stock figures though it can be assumed that the estimates were based on some set of data and parameters. It may be noted that accurate estimation of monthly stocks would require data on population and its growth rate, production by season and its monthly distribution of harvest, consumption by month, marketed surplus by month, inventory changes etc.

Third, among the first RRA sample farms, respectively 25, 33 and 42% were of small, medium and large size (p.11). But the actual definitions of these sizes were not given in the report. Average aman area in 1992 and 1993 for the entire RRA sample was 4.65 and 4.64 acres respectively, which implied that the sample farms were much larger than the national average. How results of the unrepresentative samples were used to blow up to get national aggregate- the kind of weighting used in the extrapolation exercise – were not explained. Moreover, the third RRA report did not show its sample distribution by size but stated that " the current RRA, by over sampling large and medium farmers to a much larger extent than was true for the earlier RRAs, has grossly overstated private

[14] The first RRA was reportedly conducted between October and December 1993 and four key team members reportedly conducted the assessment though seven other members were mentioned in acknowledgement as contributors but their actual contribution or role has not been clarified. Similarly, the third RRA reported that "a RRA team of a couple of officials representing the Ministry of Food, the office of DGF, the FPMU, Planning Commission, were sent to the field. ….. the staff of the RRA spent four days each in the field". But how many members were actually involved, what was their mode of operation etc and role were not mentioned.

stocks" (Amin and Farid, 1994, p.3). So the estimates of the third RRA could be considered even more questionable

Fourth, both the RRA reports included the survey based monthly stocks for 1989-90 by Chowdhury (1992) for comparison with their own RRA based findings for later years but in the RRA reports, the original 1989-90 figures were revised (adapted) (see Table 14) but no details of why and how those revisions/adaptations were made were given in the RRA reports.

Table 14 Economy-wide end of month rice stocks (million metric tons), 1989-90

Month	Farm stocks	Trader stocks	Total private stocks	Public stocks	Total stocks	Private stocks as ratio of rice need
October89	0.86	0.50	1.36	0.58	1.94	0.96
November	5.73	1.44	7.17	0.60	7.77	5.10
December	5.79	2.02	7.81	0.72	8.53	5.54
January90	4.73	2.04	6.77	0.82	7.59	4.80
February	3.68	1.64	5.32	0.84	6.16	3.77
March	2.71	0.66	3.37	0.75	4.12	2.39
April	3.32	1.06	4.38	0.64	5.02	3.11
May	4.66	1.66	6.32	0.65	6.97	4.48
June	3.67	1.68	5.35	0.82	6.17	3.79
July	2.99	1.34	4.33	0.85	5.18	3.07
August	3.36	0.94	4.30	0.83	5.13	3.05
September	2.43	0.72	3.15	0.78	3.93	2.23
October	1.44	0.40	1.84	0.65	2.49	1.76
Cumulative total	45.37	16.12	61.36	9.49	70.98	
Average/month	3.49	1.24	4.72	0.73	5.46	3.39
% of total stocks	63.9	22.7	86.6	13.4	100.0	

Note: Last three rows in the table are not shown by Chowdhury (1992) in the original report or in the RRA report by Ahsan et al. (1994), but they have been added here to show inconsistency with figures in table 12.

Source: Adapted from Chowdhury (1992) by Ahsan et al. (1994)

Since November 2004, the Food Policy Monitoring Unit under the Ministry Food has been using an approach for estimating private stocks of rice, wheat and total combining rice and wheat for its internal decision making purposes. A working spreadsheet template is used to derive monthly closing stock, which is being treated as equivalent to total private stocks - farm and trader stocks combined. The equation is as follows :

$$S_t = (S_{t-1} + O_t - P_t + I_t + G_t) - C_t$$

Where

S = private stock at the end of a month t
O = share of harvest of a rice crop in the month
P = domestic procurement by the government during the month
I = private import during the month
G = government off take during the month[15]
C = domestic consumption during the month
t is any month during a year. [16]

There are two main concerns about the equation and the accuracy of the resulting month end stocks. First, the estimated private stock at the end of a month is an aggregate residual without any accompanying narrative on the methodology and its output so it is unclear what it includes and how much of the stock lies where in the supply chain from producers to retailers with other intermediaries in between. Second, the real accuracy of the monthly stocks derived in this manner will depend on the accuracy of the parameters included in the identity such as carry over stocks, volume of output and monthly share of harvest, domestic procurement and disposal, population size and actual domestic consumption. There is hardly any consensus on the accuracy of the available statistics on these parameters. Some of the problems are highlighted below.

a) Population

The FPMU has been using BBS estimate for base population and annual growth rates. Annual growth has been uniformly spread over 12 months. However, UNDP and World Bank estimates show significantly larger population. For example, for 2007-08, BBS and UNDP estimates were respectively 146 million and 156 million and National Food Budget data base estimated 143 million for the same year (TAT-NFPCSP, 2008; Jansen and Fernando, 2008). Large differences in population estimates have several implications for estimation of stocks at all levels. Even a difference of one million population means annual rice consumption estimate at per capita daily consumption rate of 0.4536 kg is off by 166, 000 metric tons, which was nearly the same amount of public distribution in 2005-06. Thus, even when BBS population figures are used, the implications of other estimates need to be kept in view for sensitivity of the estimated stocks.

[15] Government off-take is a confusing term in this setting as off-take usually lies on the demand or utilization side of an equation. Perhaps what is implied here is public distribution during the month, in which case the term should be stated as such to convey the conceptually correct meaning.

[16] This can be compared with an approach followed by the Government of Ethiopia though a formal working template is not used. At the national level, the government has strategic food reserves. The NGOs or donors have their part of food stock reserves. The Ethiopian Grain Trade Enterprise (the national agency for procurement and distribution of food grain) has also its own stock. At the trader level, it has been difficult to come up with accurate estimates because most of the traders are informal, small and dispersed. However, the government keeps track of rough estimates based on the capacity of the formal trade sector, and a guesstimate of the capacity of the informal sector. At the household level, production estimates are made for every season. Produce utilization structures are estimated (consumption, seed, loss, carry over stock, marketable surplus) and estimates are made of the monthly available stock at household level. All of these are integrated at the national level to check monthly and quarterly stocks taking into account carryover stock + Production + Import – export being equal to estimated total stock at the national level (Berhanu Gebremedhin, Senior Economist, International Livestock Research Institute, Addis Ababa, Ethiopia. Personal communication).

b) Domestic production and monthly harvest

In the private stock estimation template, BBS estimate for annual rice production figures are used. Once BBS estimate for a rice crop is available, FPMU works out monthly distribution of the total estimated net output. In the template, the following monthly shares of harvest of the three rice crops have been used since November 2004:

- Aman - November 10%, December 60%, January 30%
- Boro - April 5%, May 40%, June 55%
- Aus - July 25%, August 60%, September 15%

The bases of these monthly ratios are not known but there are three concerns. First, BBS estimates of production are based on elaborate crop cuts, so they are not available until after the data have been aggregated and analyzed. This means, FPMU's monthly stock estimation can't in reality be materialized on a current month basis rather they have to be done with a significant degree of lag, which reduces the utility of the exercise. Second, the use of constant monthly harvest ratios year after year is questionable. Crop calendars may change by a few days or by one or two weeks due to many reasons – early or late rain, flood situation, availability of seeds or fertilizers etc. resulting in variable planting and harvest times. Third, monthly harvest pattern has implication for monthly sales pattern and stocks. For example, Bayes and Hossain (2007) has shown that in 2003-04, 42% of total sales of paddy occurred within the first month of harvest, in case of small farms it was 65%. They did not report the calendar months of sales. However, if we take the FPMU distribution of harvest as shown above, only 10-25% of harvest of the three rice crops occurred in the first month of harvest. It is doubtful if the sales out of the harvests of the first harvest months would match the equivalent of 42% or 65% of total sales during the year, even if it was assumed that the entire harvests of the first harvest months of each rice crop were sold. Since BBS collects production data based on crop cuts, it is likely they do so over the entire harvest period or at least over a major period of the harvest rather than at a point in time. Therefore, it should be possible for BBS to present estimated production data with a monthly breakdown of the harvest, which will then allow FPMU to make its stocks estimate not only in terms of total output but also its monthly distribution of harvest.

The problem of time lag in obtaining BBS estimate of rice output may also be handled in a different way by linking with the estimation procedure of the national food budget. The provisional national food budget for a given fiscal year is prepared on the basis of Department of Agricultural Extension (DAE) estimates/targets for each cereal crop. DAE figures are occasionally revised upward or downward in the course of the year but are ultimately replaced by actual/final production figures from BBS, as they become available, about six months after harvest (TAT-NFPCSP, 2008). It has been observed that final BBS estimates have been always lower at varying degrees from the DAE estimates/targets – the average difference has been about 5% or so. DAE's is mostly a projection or target while BBS's estimates are based on results of a large number of systematic crop cuts throughout the country. Since BBS estimates are about 5% lower

than DAE targets, from the beginning the national food budget may be prepared assuming production at 95% of DAE target, and revised/adjusted when actual BBS figures became available. This would most likely give more accurate estimates of monthly food budgets and less degree of required adjustment than what has been produced by the current procedure. If FPMU also follows the same procedure, i.e., pick up the production estimate used in the national food budget, it should be possible to generate monthly estimated stocks more regularly and with a better degree of accuracy and synergy with the national food budget.

c) Net output

In line with BBS, FPMU has been making a 10% deduction for 'seed, feed and wastage' (SFW) from gross production to get net output for disposal. Following a recent directive by the Ministry of Agriculture, a 12% deduction is now applied by both FPMU and for preparation of the national food grain budget (TAT-NFPCSP, 2008).[17] This has implication for estimated private stocks. For example, other things remaining the same, a 2% increase in allowance for SFW means that net output in 2005-06 would be 24.0 million metric tons instead of 24.54 million metric tons - a reduction of 0.54 million metric tons, which was equivalent to 57% of the total volume of domestic procurement by the government in that year. In 2006-07, the reduction in net output would be 0.56 million metric tons – equivalent to 49% of the total volume of domestic procurement in that year. Estimated private stocks as a residual, therefore, would be lower by the same amount but the real private stocks might be higher than the estimated residual because the higher deduction rate for SFW means larger quantities were left on-farm. Given this implication, it is questionable if a 12% or a higher rate of deduction is justified to get net output. The fact that other Asian countries use similar or higher rates on SFW account does not provide a strong logic for using similar rates in Bangladesh. Though sometimes it is casually claimed that there are high post harvest losses, evidence from marketing studies suggest that on-farm storage losses are no more than 5% (see for example, Islam et al., 1987, Akter, 1989, Quasem, 1987; Alam and Afruz, 2002; Murshid et al quoted in TAT-NFPCSP, 2008).[18] Feed use of rice for ruminant livestock is not a visible practice in the country though rice bran is used as feed. So if we assume that half of 12% covers wastage and feed use, the other half may be used as seed. But what is the real requirement for seeds? Does the allowance made include adequate amount for seeds or is there a surplus or deficit in relation to requirement?

Requirement of seeds depend on acreage to be planted next season and seed rate, which vary according to season/type of rice crop and variety. Table 15 illustrates the situation for aman rice in 2004/05 and 2005/06 seasons. Portion of SFW allowance from 2004/05 harvest was used as seeds in 2005/06 season. It appears that at standard or recommended seed rates, only about 5.2-6.5% of 2004/05 local and broadcast aman output was used for

[17] Some Asian countries use similar or even higher rates. For example, for rice, Nepal and Pakistan use 10%, Sri Lanka uses 11.5%, Laos and Cambodia use 18%. India uses 12.5% for all cereals (TAT-NFPCSP, 2008).

[18] Public and private import stocks are also subject to frequent losses for various reasons, which also need to be properly accounted for.

planting the 2005/06 season crops. For HYV aman, 1.2-1.4% of the output and for aman as a whole 2.5-3.0% of the output was required for planting the next season crop. In that case the remainder, i.e., about 5.5% for local and broadcast aman, about 10.6% for HYV aman and 9.5% for overall aman remained as allowance for feed and wastage. Wastage and other losses are supposed to be least for the aman crop, so these allowances would appear to be unreasonable or too generous, especially for HYV aman as well as aman overall. Empirical marketing studies found losses and other uses in the order of 5-6% of output overall. If this was applied to all aman crops in 2004/05, then a 12% allowance for SFW means 3.5-4.5% of output or 344,000 - 442,000 tons of output, was left on-farm as excess allowance for wastage and losses which in reality was at the hands of the farmers for consumption or other form of disposal. So the FPMU estimated private stocks for aman for that year was lower by the same amount. Similar excess allowances were also made for aus and boro, thereby increasing farmers' real stocks while reducing FPMU's estimated stocks. [19]

Table 15. Allowance for seed, feed and wastage in in 2004/05 and seed requirements in 2005/06 aman seasons respectively

Crop	2004/05			2005/06		
	Acreage, 000 ha	Production. 000 mt	SFW (12 % of production) 000 mt	Area, 000 ha	Seed needs* 000 mt	Seed as % of 2004/05 production
Aman broadcast	494	458	55.0	500	25-30	5.4-6.5
Aman Local	1879	2668	320.2	1730	138-173	5.2-6.5
Aman HYV	2906	6693	803.2	3193	80-96	1.2-1.4
Total**	5289	9819	1178.3	5423	243-299	2.5-3.0

* Recommended seed rate per ha : Local aman 80-100 kg, HYV aman 25-30 kg, broadcast aman 50-60Kg
* Acreage and production figures differ by source. For example, Hossain and Deb (2009) quoting BBS reported aman acreage of 5432, 000 ha and output of 8600, 000 mt for 2004-05, so SFW at 12% would be 1032, 000 mt.

Source: IRRI, Bangladesh Rice Knowledge Bank (BRKB), BBS & DAE

A more fundamental issue here is whether there is any justification for continuation of bundling 'seed, feed and wastage' together in this deduction exercise for estimation of net output. Seeds are a tradable commodity and many farmers no longer depend on own paddy seeds rather buy from market supplied by other farmers as was found in a number marketed surplus studies, and increasingly seed multiplication firms or companies also supply the market. Certain amount of seeds, e.g. hybrid seeds, is also imported. Therefore, the assumption that a constant portion of output remains on-farm as seed, feed and wastage may not represent the reality on the ground. It may be advisable to exclude

[19] This could be an explanation for the anomaly observed in some years when quantities of private imports were quite large even though output was also large (TAT-NFPCSP, 2008 and personal communication). Perhaps this was due to unreasonably large allowance for SFW, thus reducing the aggregate accounting stock, and signaling importers the need for import.

seeds from the SFW bundle under the current circumstances of rice production and marketing in Bangladesh, and show seeds as a separate form of disposal like consumption in order to get realistic estimate of private stocks.

d) Daily consumption rate

The FPMU has been using 16 ounces or 453.6 gms of rice consumption and 17.25 ounces or 489 gms of cereals per capita per day to estimate aggregate domestic consumption of rice and cereals respectively. But annual consumption rates have shown variation over time. For example, the Household Income and Expenditure Survey 2005 showed per capita per day consumption of 469.2 gms of cereals of which rice accounted for 439.6 gms (BBS, 2007, p.45). Though seasonal variation was not analyzed, it can be reasonably assumed that there were significant differences in consumption between seasons, especially in the rural areas. For example, a baseline survey conducted by IRRI and three NGOs- CARE, Practical Action and Action Aid - on 2181 poor and marginal households spread over several districts found that 60% of the sample households reduced quantity of food grain consumption in the month of Kartick due to shortage in food supply, about 50% did so in Aswin and Choitra, about 30% did do in Baishakh and Falgun, 24% in Bhadra, 13-16% in Aashar and Shrabon and the lowest 9% did so in Jaistha and Poush (IRRI, 2007). Therefore, use of a constant per capita yearly rate year after year is questionable. Also it is unclear how utilization rice in other forms such as industrial uses has been handled in the consumption estimate. In so far as use other than human consumption is excluded, estimated private stock will be over estimated.

There are other figures for cereal and rice consumption rates in the country. A working paper on national food budget preparation has shown scenarios of food budget on the assumption of the nationally recommended cereal consumption of 486.2 gm/day, FAO recommended rate of 496.6 gm/day, and nutritionally desirable cereal consumption rate of 405 gms/day. All these are also constant rates for a given year and they are normative rates which may or may not be achieved in reality. A difference of 1 gm per capita per day consumption can change the estimated private stock by a significant volume. For example, for a population of 145 million, 1 gm consumption difference per day will mean a difference of 4350 tons of grain for a 30 day month. Therefore, application of a constant daily rate of consumption for several years is likely to distort actual consumption and estimated stocks for the months and years. If a constant rate is to be used any how in this exercise, one possibility is to use the current rate but also estimate alternative outcomes using different assumed consumption rates in order to provide possible range in estimated stock.

There is also a suggestion to use '**apparent consumption'** as a basis to prepare national food grain budget including estimation of private stocks. Apparent consumption has been defined as (net production + imports + change in stocks)/population and this is interpreted as the consumption rate that will balance the supply and utilization of food grains in a given year based on trend in production and utilization over a number of years assuming zero stock variation (TAT-NFPCSP, 2008). The apparent consumption rate is based on the assumption that consumption tends to remain stable over time with variation remaining within the bounds of production plus import and carry over stocks. Since it is

a derived variable, if it is considered suitable for preparation of the yearly national food grain budget, its inclusion within the FPMU template for monthly stock estimation can be tested first to see if the results are meaningful and close to reality. If found suitable, its use within the FPMU template can be facilitated by interactively linking it with .any software used for the national food budget preparation.

Further studies should be conducted to establish month, or at least season, specific per capita consumption differences, so that in the future such information can be used for more accurate estimation of monthly stocks.

4 New data available for analysis of farm level marketed surplus, marketing pattern and stocks

Social science researchers conduct surveys with specific objectives in mind to test specific hypotheses, so they use survey designs to suit those objectives and data needs. However, it has been observed that most surveys collect much more data than are required for testing the postulated hypothesis(es) and most surveys end up analyzing only a portion of the entire data during the life of the project due to time and resource limitations. Rest of the data remains on the shelf for years before disappearing. Therefore, well designed and executed surveys with wide scope and data coverage can be a useful and economic mechanism for testing new hypotheses that were not part of the original design, so long as the data are not too outdated. Even if such data sets may not contain everything that may be ideally required to test new hypotheses, these may still be useful as the second best sources as they will save the time and resources required for conducting new surveys. At least, the scope of finding new answers form old data should be explored before embarking on new surveys.

Keeping the above in view, a number of available recent large surveys that have not been fully exploited were identified to see if the available data would permit analysis of marketed surplus, marketing pattern and household stocking behaviour. These are:

- Household survey to assess the adequacy and effectiveness of diesel subsidy for small and marginal farmers in 2007-08 conducted by BIDS with funding from DFID and the World Bank
- Household survey component of a study to assess market integration, price stabilization and consumer welfare in 2007-08 by the Bangladesh Rice Foundation with funding from the FAO.
- The household income and expenditure survey 2005 conducted by the BBS.

The agricultural census 2008 conducted by the BBS included only household information, occupation, and inventory of assets/resources and did not include any production and disposal data for marketing analysis. Therefore, the scope of new analysis with data from the other three sources is outlined below.

The survey on diesel subsidy was a one shot survey conducted in several districts to collect data covering all three rice crops for the year 2007-08 (June 07 – July 08). The survey included the following production and disposal parameters for each rice crop:

Section 5.1: Land holding

- Own and all incoming land due to rent, mortgage etc have been recorded. Caveat is that it is unclear how own land rented or mortgaged out has been treated (also see section 5.2 and 5.3)

Section 5.2: Use of agricultural land

- For each plot amount of production, amount paid for irrigation charge, for harvesting and threshing wage, for rent of rented in land and net amount harvested

or taken home have been recorded. Caveat is that it is unclear how the output etc of owned but rented out land has been treated

Section 5.3: production and value of crops

- Output from own plot and non plot has been distinguished, then the following parameters have been recorded for each plot: amount net harvested or taken home, amount of rent received from rented out land, value of share of input cost for rented out land, amount of other payments in kind, quantity and value of forward or advance sale, quantity and value of sales to government procurement programme, quantity and value of direct sale to rice mills, quantity and value of sales to other places, quantity of home consumption up to the point of the survey date, quantity of remaining stock on survey date. So although rented/mortgaged out land was apparently not clearly identified in section 5.1 and 5.2, output received from such land has been recorded in this section.

It appears that product disposal avenues have been recorded in both sections 5.2 and 5.3 but they are not exactly the same. It is conceivable that data collectors had experienced some difficulty in synchronizing information for sections 5.1, 5.2 and 5.3 because of the way the data were organized so it will require careful handling to derive marketed surplus ratios, stocks and other results. The primary task will be to check if there is a balance between supply and utilization before specific questions can be investigated.

The household survey for assessing consumer welfare was conducted in a multistage stratified random sample of 405 households selected from 6 villages representing 9 agroecological zones in the country (Chowdhury, 2009). Apparently, repeat survey was conducted once every quarter during 2007-08. In each quarter, the following information was included:

Section 1a: Land holding

- Own land and all incoming and outgoing land have been recorded

Section 1b: Crop related information for last six months

- For each crop including three types of rice, the following parameters have been recorded: land area, quantity and value of output obtained, amount paid as rent to land owner, as wage to labourer, used as seed, used as animal feed, amount of wastage, and other uses; amount sold and amount consumed
- Monthly utilization of produced output for last 12 months. This was done for rice as group and some of the other crops like potato and maize. For rice, the monthly records included the following in kgs: carry in from previous month, received from other sources, own production, total stock or supply, consumption, sale, seed use, loan out, other uses, total use or disposal, closing stock.

Section 9: Consumption food grain for last three months (from own production, purchase and receipt from other sources)

- Information were recorded for rice as a group, wheat, flour, other cereals and other food items and the following parameters were recorded : total amount

consumed, amount and price of purchase, amount from own production, amount and name of source for received from other sources.

Section 10: Social Safety Net programme

- Information in participation in various programmes and amount of rice and wheat received in last three months and before that were recorded. This is likely to serve also as cross check with food grain receipt reported earlier in other sections above.

There are two main concerns about the data content of this survey. First, identification of crop categories, especially rice, has been more disaggregated in some section and aggregated in others. So all types of analysis possibly can't be done for specific rice crop though the quarterly survey should have allowed to do that. Second, several reference time periods e.g., last six month, last three months, specific months in a full year etc have been used in different sections for data. Given that the survey was conducted quarterly, the overlapping reference periods might have created confusion among both the enumerators and the respondents, which might have compromised the quality of the data. Therefore, before marketed surplus, stock levels and other outputs are calculated, the primary task will be to check if there is synergy among information recorded in different sections and between different quarterly surveys, and if there is an accounting balance of the various supply and utilization figures in various sections for the whole year, i.e., do they add up in a meaningful way.

The Household Income and Expenditure Survey 2005 was conducted by the BBS on a well designed panel sample covering information for the year 2005. In section 7 of the questionnaire, the following information was included:

- Land holding including own land, rented or mortgaged in land, rented or mortgaged out land
- For each specific crop including aus, aman and boro rice the following information were recorded:
    - Amount of land devoted to the crop
    - Total output received and unit price
    - Amount given to land owner
    - Amount kept for wages
    - Amount used as seed
    - Amount used as animal feed
    - Amount wasted
    - Amount for other uses
    - Amount sold
    - Amount consumed by the household

There is small question about the way output has been defined and output for rented land has been treated. It appears the total output includes output from all cultivated land, i.e. it may not include output from rented/mortgaged out land. While rent paid for any rented land has been recorded, rent received for rented out land has not been apparently recorded. The other concern is that sale and consumption for the whole year has been recorded as one aggregate figure without breakdown over time, which may create

difficulty for accurate reporting by respondents. However, an account balance test to validate synergy between supply and utilization will point to any deficiency with the data. With required clarification of the above from the BBS, the data set may be used for analysis of marketed surplus, marketable surplus and other related parameters.

5 Summary and recommendations

5.1 Summary

Marketed surplus is an important element in the estimation of private stocks. Theories and models are abstractions of real world situations. Ideally, theory should guide model construction and data collection for estimation of model parameters or validation of models. Sometimes available data may be adequate and suitable for testing the intended model. But most of the time, available data are not fully adequate to test a model as the data was not collected to accommodate the specific needs of all models. Yet available data may guide construction of the best possible conceptual framework and model under certain restrictive assumptions. Attempts hitherto made for estimation of marketed surplus and private stocks of rice in Bangladesh fall in both the categories. In some cases, data collection followed from concept and analytical model especially when small sample based assessments have been made, while in other cases, especially at the aggregate level, issue of interest such as private stocks has been derived from available data using plausible accounting identities and related assumptions. Although some studies used disaggregated dynamic market model to study the role of consumption and storage demand on price movements at the aggregate level, in the absence of direct measures for consumption and private stocks, indirect measures were used to estimate the stock variable.

Generally, three concepts of marketed surplus ratios have been used in empirical studies – gross marketed surplus, net marketed surplus and marketable surplus. Gross marketed surplus has been generally defined as sales as a share of current gross output. But sometimes, rather than gross output, net output after deduction for 'seed, feed and waste' has been used as the base. Net marketed surplus has been generally defined as net sales (sales minus purchases) as a share of gross or net output. Marketable surplus has been generally defined as potential ability to sell after meeting own consumption needs or consumption needs plus other obligations such as wage payment in kind, irrespective of whether there was any actual sale or not. As such marketable surplus could be negative or positive. In empirical studies, several deviations from these general definitions were observed - some more serious than others with important implications for the estimated marketed surplus ratios and stocks. From the literature, what is evident is that gross marketed surplus ratio for paddy increased from about 10% in the late 1960s to about 25% in the 1970s, to over 40% in the more recent years (Table 16). However, the accuracy of the reported ratios are questionable and they can't be always compared straight way because of conceptual problems and deficiencies and inconsistency in the definitions and measurement procedures applied. Net marketed surplus and marketable surplus have been estimated in fewer studies and figures are less clear because of the varieties of definitions used.

Table 16. Estimated gross marketed surplus (%) of rice for selected years, 1964- 2004

Reference year	Source of data	Boro rice	Aus rice	Aman rice	All rice
1964/65	Raquibuzzaman, 1966				10
Mid 1960s	Ahmed, 1979				10-14
1973/74	Planning Commission				19
1976/77-78/79	In Dey, 1988*				34
1977	Quasem 1979			30-40	
1979/80- 81/82	In Dey, 1988*				36
1982	In Dey, 1988*	43	24	18	28
1982/83-84/85	In Dey, 1988*				39
1982/83	Islam et al , 1987				25
1982/83	Akter, 1989				23
1986/87	In Dey, 1988*				42
1986/87	Murshed & Rahman,1988				26-36
1989/90	Chowdhury, 1992	64 or 82?	64	34	49
2001/02	Alam and Afruz, 2002	58	38	48	na
2003/04	Bayes & Hossain, 2007				41

* For original data sources for these, see Dey (1988)

Note: There are some differences in the definition of gross marketed surplus used in the studies quoted in the table, so the ratios are not always directly comparable but they provide adequate of order of magnitude to get a rough approximation

The main problems in measurement are inherent in the general definitions mentioned above whereby production, consumption, sales and purchases have been considered as elements in defining marketed or marketable surplus. In the smallholder production system in Bangladesh as elsewhere in the developing countries, in addition to sales, transactions and transfers may take place among producers due to rent, in kind wage payment, gift, loan etc. Moreover, due to seasonality of harvest and more continuous consumption needs, significant inventory changes between two seasons or years may occur- output of a season or a year is not fully disposed of within the season or year. Thus the volume of food grain available on a farm over time depends on the volume of incomings due to new harvest, purchases or receipts for other reasons and outgoings due to consumption, sales and payments or giving away for other reasons. In fully commercial production systems or systems in which non-sale transactions and transfers and inventory changes is zero or negligible, sales as a percentage of net output is a good measure of marketed surplus or commercial off take rate. However, where non-sale transactions and transfers and inventory changes involve a significant proportion of output, accurate estimation of marketed surplus at the individual household level will require proper treatment of non-sale inter-farm transactions and transfers although such transfers are supposed to cancel out at the aggregate level.

For private stock estimation, three major types of procedures have been used – farm and trader survey based estimation of on-farm and trader stocks, RRA based estimation of

farm and trader stocks, and aggregate national level estimation of private stocks (on-farm and trader stocks combined) as part of a food monitoring exercise rather than as research *per se*. Farm level estimates suffer from some conceptual deficiencies because it is unclear if and how opening and closing stocks and other inter-farm transfer and transactions have been handled. The absence of full accounting of transactions and transfers might have rendered the estimated private stocks inaccurate. RRA based estimates suffer from a serious lack of detail and clarity on how the RRAs were conducted and how the stock levels were actually derived.

The FPMU estimate is an aggregate national level measure of private stock and it does not indicate where in the supply chain lies how much stock. Moreover, the aggregate estimates are based on statistics on key parameters like population, gross and net production and its monthly distribution, marketed surplus and its monthly distribution, consumption rate etc which may not be fully accurate and universally accepted or agreed, thus having implications for the results obtained on private stocks. Also some parameters are likely to be more stable over time than others, e.g. population growth is likely to remain stable during a year but marketed surplus may be more variable due to differences in seasonal output.

The various studies have provided useful knowledge about marketed surplus and private stocks, especially as there is serious dearth of information on these issues. However, due to conceptual deficiencies or limitations and poor quality of statistics used, the accuracy of various findings remains suspect.

As the rice economy expands both in terms of larger output from better technologies, and greater market participation by producers with larger marketed surplus, it is essential to make efforts to get reasonably accurate estimates of marketed surplus and level of private stocks in the country that may be useful in the formulation and implementation of food grain procurement and distribution policies. The conceptual and methodological deficiencies of the past studies have been identified, which also indicate possible areas of improvement to develop a framework for more accurate estimation of marketed surplus and private stocks using appropriate definitions, identities and measurement procedures

5.2 Recommendations for marketed surplus estimation

Some of the major issues that need careful consideration for proper estimation of marketed surplus and related parameters under the prevailing systems of production and disposal of paddy in Bangladesh are the following:

Net output – BBS and DAE currently deduct 12% for 'seed, feed, waste' from gross output. Farm survey based marketing studies have used various rates under different implicit or explicit assumptions. Question is whether there is a justification for bundling these three items together and whether deduction rate of 12% is justified. Empirical studies showed that in recent times, wastage and feed accounted for about 5-6% of gross output. The remaining 6-7% does not appear to be required for seeds, especially for transplanted HYV aman and boro. For example, at recommend seed rates, local and HYV

aman respectively requires 5-6% and 1-2% of output as seeds for next year planting. Thus potentially larger quantities are left on-farm as allowance for SFW than is required thereby underestimating the available supply for sale and consumption. Moreover seeds have become a tradable commodity as many farmers no longer depend on own seeds rather buy from the market supplied by other farmers and seed companies, and some amount is also imported. Therefore, seeds should be treated as a tradable commodity and shown separately as actual consumption (used for planting) like grain consumption and/or as sale where appropriate. Allowance rate for wastage and feed or other uses should be crop specific rather than uniform and empirical studies should be conducted – rapid appraisal included – to establish the actual rates of seed use, wastage, and other uses, so that a more robust empirically based allowance for these items can be made.

Gross marketed surplus –The general practice is to treat only sold amount as equivalent to marketed amount. The question is whether other in-kind outgoings except own consumption could also be treated as marketed. In reality anything that leaves the farm over own consumption - whether in the form of sale or in-kind payment - could be treated as sales, as in-kind outgoings could be sold and the payments could be made in cash (the opportunity cost principle). RRAs may be conducted to determine actual or estimated marketed volume. For example, Bayes and Hossain (2007) have shown that about 14% of households, usually large and medium land owners, supply 92% of marketed surplus of rice. So a focused RRA on such farms may provide robust information on a large part of the disposal pattern including sales.

Net marketed surplus – The general practice is to deduct purchases from sold amounts to get net marketed amount. The question here is whether sales and purchases are adequate ingredients to get net marketed amount when non-sale and non-purchase transfers and transactions account for a significant portion of output, and they do not cancel each other for the individual farm even if they do in the aggregate. The answer is that from an accounting point of view, for the individual farm, net marketed amount should be derived by taking into account all incomings and outgoings rather than only purchases and sales.

Gross marketed surplus ratio – The general practice is to calculate gross marketed amount as a percentage of gross or net output. The question here is whether gross or net output is the appropriate denominator. In reality sales (plus other outgoings) occur not just from own production – gross or net- but from available supply, i.e. own production plus incomings. Therefore, the appropriate denominator for estimation of gross marketed surplus ratio is available supply rather than just output. [20]

[20] In smallholder livestock systems, inventory of livestock on a farm may change over time during a season or year due to sale as well as various non-sale transactions and transfers. For such systems, gross marketed surplus has been measured as sales as a percentage of average inventory during the year, and net marketed surplus is measured as sales net of purchase as a percentage of the average inventory during the year. See, for example, Barrett et al (2004), Bouman et al (2005), Negassa and Jabbar (2008).

Net marketed surplus ratio – The general practice is to calculate net marketed amount as a percentage of gross or net output. In line with the gross marketed surplus ratio, here also the appropriate denominator should be available supply rather than just output.

Marketable surplus – The paramount assumption behind this concept is that achievement of food grain self-sufficiency from own production is a desirable goal. From a livelihood and food security perspective, for small and marginal farmers who may make distress sale, marketable surplus may indicate the welfare implications of their sales. However, as a general rule, the relevance of this concept declines along with increased commercialization of agriculture. When even smallest farms buy and sell paddy along with other daily necessities and the production and marketing decisions are guided by market and profit motive as well as concern about food security and livelihood, marketable surplus and its ratio may be derived as an accounting output but problems of identifying appropriate numerator and denominator, as discussed above with respect to marketed surplus ratio, still remain. Moreover, without a full accounting of the farm's other activities and income, few policy implications can be derived from marketable surplus as a parameter.

There are a number of large data sets that have been generated in recent years for various rice policy research purposes, e.g., the study on diesel subsidy in 2008 by BIDS, the study on market integration in 2007/08 by Rice Foundation, and the Household income and Expenditure Survey 2005 by the BBS. They contain detailed information for conducting marketed surplus, marketing pattern and stock analyses. These data have not been fully exploited, so these may be fruitfully used for additional analyses until new surveys are conducted. Especially an analysis of monthly pattern of transaction – both sales ands purchases by farmers – and their determinants such as yield rate, access to credit, existing and expected prices, will be very useful as background information for more accurate private stock estimation over time.

5.3 Recommendations for private stock estimation

Private stocks can be estimated at farm, domestic trader and private importer level as well as at aggregate level encompassing all the levels in the market chain. For farm level estimation, the corrective measures suggested for the estimation of marketed surplus and monthly marketing pattern will allow more accurate estimation of farm level stocks over time. Future marketing studies should be able to generate more accurate stock information if appropriate concepts and definitions are used in designing studies. Understanding trader level stocks will require proper information on business behaviour of various types of traders e.g. those involved in simple speculative buying and selling, spatial arbitrage of different degrees and value adding activities like processing along with speculative buying and selling . The main difficulty in making any reasonably accurate estimate of trader level stocks lie in the multiplicity of traders operating in a complex marketing system in which a large volume of grains keep flowing from one agent to the other while some portion may remain stationary for certain period. Information on the frequency and volume of these movements and retentions are hard to get by. In theory, compulsory reporting requirements may be imposed on licensed

traders to compile national statistics on grain stocks and flows but in reality such a procedure is unlikely to be practicable in the current context of the country. Voluntary disclosure may be an option that may not generate fully accurate statistics but can be accepted as second best – these will contain some degree of error but can be validated by other data sources and parameters. Periodic rapid surveys on traders may also be conducted to assess stocks and flows.

For aggregate level estimation of stocks, the tool used by the FPMU is useful but its output can be made more accurate by addressing some of the problems related to concept and data quality. Based on the conceptual and data quality problems discussed earlier, several specific areas are suggested below for improvement in the estimate.

Initial opening private stock: The FPMU template has been inoperational for some time due to lack of up to date data in time. A reasonably accurate estimate of opening private stock at a point in time is essential to reactivate the operation of the template. This will require a census of the private stock (inventory) available to all agents – farmers, traders, millers- along the chain at a particular point in time. A PRA on each type of agent may be conducted simultaneously within a short period of time, say one-two weeks, to get this estimate. Marketing and stocking behavior of producers and traders may change due to many factors such as actual and expected price, access to credit, yield prospects for the next crop etc, so it is not advisable to spread any PRA over more than two weeks. Statistical probability based sample size determination can't be practiced in PRA but for each type of agent, the size should be manageable and adequate to get reliable estimate. There will be a degree of error in such an exercise but error level can be gradually reduced over time once real hard data on various elements of the equation are incorporated as the practice continues.

Net production – There are two problems related to the data – timeliness of access and the level of accuracy. The practice is to use BBS estimates but there is time lag to access data as BBS figures are based on a large number of crop cuts throughout the country. Consequently monthly stocks can't in reality be estimated on a current month basis, or with a minimum lag period, which reduced its utility to some extent. One possibility is to use adapted DAE estimates as these are targets or projections, then adjust when BBS figures become available after several months. The adaptation of the DAE estimate is that over the years BBS estimates have been shown to be about 5% lower than the DAE targets/projections. So 95% of DAE projection can be used for initial estimation of stocks, and the estimates may be revised once BBS figures become available. This is likely to give more accurate estimate and less degree of required adjustment and it will permit more regular generation of stock data for policy purposes

The issue of accuracy relates to the deduction of 12% of gross output as seed, feed and wastage by BBS and DAE, which is taken by FPMU as given. The rationale of this rate of deduction is questionable and it has been elaborated while discussing problems of marketed surplus estimation. Although FPMU is just an information taker in this regard, the rate has implications for the accuracy of its private stock estimation. Therefore, it is recommended that FPMU should continue to use the current 12% deduction rate but

should conduct or encourage others to conduct rapid and detailed surveys to validate the rationale for 12% deduction for seed, feed and wastage- giving attention to each component in the bundle separately. Such studies are better done jointly by FPMU, BBS and DAE. Depending on the findings, the allowance may be revised in the future for net output calculation if necessary. Further, it may become more rational to remove seeds from the bundle and consider seed consumption or use as a separate entity like human consumption of grain. In that case the identity for private stock estimation will need to be modified at a later date.

Monthly harvest share – The practice is to use constant monthly ratios over the years, which seems questionable. For the time being, the currently used ratios may be used but efforts should be made to validate these ratios and revise these if required based on up to date information. BBS conducts crop cuts to generate output data, so they may also provide data on monthly distribution of harvests of different rice crops, which will be more realistic. Regular RRAs may also be conducted in conjunction with BBS and DAE to establish monthly harvest shares.

Population for domestic consumption estimation – The practice is to use BBS estimates, which is reasonable but needs careful consideration of other estimates such as UNDP, World Bank, to avoid major discrepancies in estimates. One possibility is to have alternative assumptions about population and have alternative estimates of private stocks.

Domestic consumption rate of grain – The practice is to use an assumed constant rate over the years. Actual consumption levels have been shown to vary from year to year and between seasons within a year. This raises question about the use of constant rate for the whole year over time to estimate private stocks as a residual. Although the currently used rate may be continued, it is advisable to make alternative estimates applying other possible rates such as 'apparent consumption rate' which gives relatively stable consumption rate with some year to year variability within the bounds of production plus import and carry over stock. Moreover, studies should be conducted to establish month or season specific per capita consumption rates for more accurate estimation of stocks in the future.

Given some uncertainty and level of error in data pertaining to various elements in the equation due to conceptual and other problems discussed earlier, rather than a single valued estimate, whose accuracy may remain suspect, it may be advisable to generate a range of stock estimates as scenarios under alternative set of assumption on parameters for which definitive statistics may not be available. This will allow more flexibility in policy decisions on imports and other aspects of food stock management.

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