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**DETERMINATION OF
PROCUREMENT PRICE
OF RICE IN
BANGLADESH**

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INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

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OF RICE IN BANGLADESH**

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FOREWORD

In early 1989, the International Food Policy Research Institute entered into a contract with the U.S. Agency for International Development (USAID), Dhaka (under contract No. 388-0027-C-00-9026-00), to conduct research on food policies and to extend technical assistance to the Ministry of Food, Government of Bangladesh. The Bangladesh Food Policy Project is the basis for a tripartite collaboration between IFPRI, the government of Bangladesh, and USAID, Dhaka. This project consists of four subprojects and a large number of well-defined research topics. The subprojects together constitute a comprehensive approach for addressing the food policy problems in Bangladesh. They include the following studies: a price stabilization framework encompassing public and private marketing, evaluation of the effects of targeted distribution of foodgrains on consumption and nutrition, diversification of agriculture as a source of sustained growth of production, and capacity-building in food policy analysis.

This paper on determination of the procurement price of rice that the government adopts in its domestic foodgrain procurement operation is an important component of the first subproject. The level of the procurement price is a significant determinant of the volume of procurement, stability of market prices, and the cost of the public foodgrain distribution system. It is hoped that this study will enable a greater degree of efficiency in the price stabilization operation of the government than has been possible in the past.

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Series Editor and Project Director
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1. SUMMARY

This report attempts to develop a consistent approach to determining the procurement price of rice and improving the operational effectiveness of the procurement program in order to support farm-level prices of rice at harvest seasons. The report was prepared at the request of the government in connection with the decision on a procurement price for the 1991/92 crop season. Even though the 1991/92 procurement price was the immediate concern, the framework for deriving estimates of procurement prices will remain valid for general application in other years if the price support program continues in Bangladesh.

The paper does not examine the economic justification for the procurement program. It (1) clarifies the objective of the procurement program, (2) develops criteria for determining the procurement price, (3) applies these criteria to derive the procurement price for the 1991/92 crop season, (4) examines factors determining the effectiveness of the program, and (5) outlines the main ingredients for a competitive mode of procurement through open tenders.

The paper argues that the main objective of procurement should be to support prices for farm-level incentives. It is counterproductive to include other objectives, such as public stocks and distributional considerations; such a diffusion of purpose serves no objectives adequately. Achieving multiple objectives requires multiple instruments, and the procurement program is a single policy instrument that cannot be used to mitigate all problems. The objective of price support through public procurement is explained as a part of a fuller scheme for price stabilization in which open market sale is the other blade of the stabilization scissor.

Three criteria are considered in determining procurement price: (1) cost of production as a check on the rate of return to land and farm entrepreneurship, (2) world price as a check for ensuring that domestic prices are not greatly different from the prices that would allow the government to use opportunities presented by the world market, and (3) domestic market prices that will ensure feasible and efficient price stabilization. This paper discusses the pros and cons of each of these criteria and the procedures involved in applying them. It is argued that the market price should be the main criterion, with the other two serving only as bases for marginal adjustment when emerging changes warrant such adjustments.

For the 1991/92 procurement season, the cost of production criterion yields an estimate of Tk 301 per maund of rice; the world price criterion generates an estimate of Tk 308, and the market price criterion gives an estimate of Tk 346. Although the task of making a

choice is made difficult by the use of three criteria, the criteria do indicate the direction in which the procurement price needs to change. The estimates of production costs provide evidence that the absolute degree of profitability in the production of rice is quite high. This estimate incorporates a profit of 50 percent even after the costs of land rent and family labor are included. The estimate based on the world price criterion is not significantly different from the estimate based on cost of production. However, the estimate based on the market price criterion is substantially higher than either of the other two estimates. This situation warrants a downward adjustment in domestic prices, which is likely to happen under free trade. The current procurement price is Tk 362 (Tk 240 for paddy). Keeping in view the political and administrative difficulties in immediate deregulation of trade, this report recommends a procurement price of Tk 345 per maund of rice and Tk 230 per maund of paddy for the 1991/92 crop year.

The derivation of a procurement price from the market price criterion involves a price stabilization framework. This is explained fully in the text. In this framework, rice is procured at market prices at or below the support price. This support price is derived as the reference procurement price for rice. Therefore, it would be proper to call this a support price instead of following the current usage in government documents of calling it the procurement price. The approach adopted to determine the support price ensures a normal profit margin for traders so that the government's role (that is, public rather than private procurement) is largely limited to above-normal production years and regions.

Most farmers sell their rice in the market, and procurement contributes to producers' incentives through its impact on market prices. However, the way in which procurement is implemented is critically important in producing an impact on market prices. The current procedure of millgate contracts for procuring rice involves almost a bilateral negotiation between an officer of the Food Department and a miller. It has many flaws. There appears to be widespread abuse of public resources through collusion among millers and public officials. The current system of procurement therefore does not affect market prices as much as it could.

The mode of procurement should be transparent and competitive enough to create expectations among traders that a fall in prices would be prevented. Procurement through open tenders involving competitive bidding is a time-honored mode that can serve this purpose. This paper briefly outlines an open-tender procedure that, in effect, transfers the transportation and packaging functions to the private sector. In addition to its impact on market prices, its cost savings would be substantial because most of the grains are procured in one region but consumed in other regions.

2. INTRODUCTION

Procurement of rice by the Food Department from domestic producers and the market has been a long-standing practice since the initiation of the public food marketing system in Bangladesh. During the 1960s, procurement by the government generally involved an involuntary delivery of rice by large farmers at a fixed price (Ahmed 1979). This used to be known as the levy system. During the 1970s the levy system was replaced by voluntary sales to the government at a fixed price. This voluntary procurement practice is currently the norm. Because of this practice, the procurement price is a significant factor in influencing how much rice the government buys.

The procurement price of rice or paddy is the price at which the government purchases such grains domestically from farmers, traders, or millers. The level at which the price is fixed and the extent to which this is effective have wideranging potential implications for incentives to producers, the welfare of consumers, budgetary costs, the behavior of market prices and supply, and the pace and pattern of agricultural growth. Therefore, the way in which the procurement price is determined deserves careful examination and serious consideration, both at the level of analysis and at the level of decisionmaking.

The purpose of this report is to analyze the principal arguments involved in determining procurement prices. To be more specific, it examines the following aspects involved in the determination of procurement prices:

- Why public procurement? What objectives are purported to be achieved by public procurement?
- What criteria are relevant for guiding the determination of a procurement price that is consistent with its objectives?
- What steps are involved in applying these criteria to estimate a procurement price, particularly for the 1991/92 rice crops?
- How does the way in which procurement is implemented affect the effectiveness and efficiency of the price stabilization policy?

This work was initiated in response to a government request for advice on the procurement price of rice that it was going to adopt for 1991/92 crops. This paper is a revised version of the original report submitted to the government. The process of revision has naturally resulted in some changes, but there are no fundamental deviations from the substantive positions taken in the original report. It is also

pertinent to mention here that the question of whether public involvement in the foodgrain market is prudent is not the concern of this paper. Given the existence of the practice, this paper focuses on how pricing rules and operational mechanisms can be made more efficient. Even though the paper was prepared for the 1991/92 rice crops, the approach and underlying procedures will generally remain valid for use in other years.

3. WHY PUBLIC PROCUREMENT?

Why is there public procurement of foodgrains and what objectives are supposed to be achieved through such efforts? Innocuous as the question may sound, a considerable amount of misdirection of procurement results from a misconception of its purpose, particularly of the relative importance of various objectives. At national forums, price support to growers is seen to be the principal objective of the government's procurement program. However, at the operational level of the Food Department, building up foodgrain stocks is perceived to be the dominant purpose. A clear understanding of the primary objectives, along with the relative weights of various objectives, is necessary in order to appreciate the logic underlying the determination of procurement price.

PROVIDING INCENTIVES TO PRODUCERS

Public procurement as a form of price support for producers' incentives appears to be widely accepted. In an opinion poll among urban business and intellectual communities, about 94 percent of the respondents favored price supports to farmers (Rahman 1992). The Ministry of Agriculture is the principal advocate of price supports as a component of its program to accelerate the diffusion of new technology in agriculture; however, the Ministry of Agriculture is often quite critical of the effectiveness of the program because of a perceived inefficiency in implementation. Incentives through procurement prices are based on the assumption that the market price of rice will be higher with a procurement program than without one. Therefore, farmers get the benefit of price incentives from public procurement. However, if the procurement operation, for any reason, is not effective in influencing the market price, the purported benefit will not be realized. Therefore, effectiveness of procurement is a necessary condition for incentives to farmers.

REDUCING PRICE RISKS

Another form of incentive is the reduction of price risk. Generally, farmers make their production decisions (for example, how much area is allocated to what crops and the amount of inputs to be used) on the basis of their expectation of the price levels that will prevail after harvest. Although farmers with a marketable surplus are more likely to make these decisions quite seriously, even deficit farmers who sell

after harvest and purchase later are likely to weigh the postharvest price situation. It is sometimes believed that small farmers, because of their weaker holding power, take the expected prices likely to prevail after harvest and during lean periods rather seriously. On the other hand, if the procurement program is not effective, the farmers' confidence in government procurement is eroded and the purported reduction in risk does not take place.

MAINTAINING ADEQUATE STOCKS

In the course of a discussion on this paper in a workshop, the representatives of the Food Department emphasized the objective of public procurement to maintain adequate stocks of foodgrains in public godowns (stores). The high level of concern for this objective resulted in extraordinary measures in certain poor crop years in the past when procurement tended to be small and the stock level in public godowns was low. The extraordinary measures consisted of raising the procurement prices in the course of procurement and undertaking special drives, including some sort of cordoning or invoking the antihoarding law. Such extraordinary measures generally destabilize market prices. Therefore, there is a potential conflict between the objectives of stabilizing prices to provide incentives to farmers and maintaining adequate foodgrain stocks in public godowns through the procurement program. It is generally difficult to attain two objectives with one instrument.

It is important to recognize that the buildup of public stocks should not be an objective of the procurement of foodgrains from domestic production. This premise should be established at the operational level of the Food Department. It does not mean that public foodgrain stock is an unimportant policy issue. What it really means is that the procurement program should serve only as a price support mechanism in good crop years. This will of course add grains to public stock as a consequence of price support operations. It will exclude public procurement when price support is provided by the market without the need for additional efforts from the government, as is usually the case in poor harvest years. Maintenance of an optimal stock, given current distribution programs of the government, is a separate issue that should be addressed by importing foodgrains when procurement of domestic crops does not meet the demand for an optimal level of public foodgrain stock.

PROVIDING FARM INCOME TO SMALL PRODUCERS

Although it is seldom considered a primary objective of procurement policy, the farm income of small producers of rice is often advanced as an important purpose of procurement. Thus, it is argued that small farmers generally sell immediately after harvest to meet various cash demands and repay debts. This argument then is extended to propose a

higher procurement price than is normally determined (such an argument was also presented in the workshop mentioned earlier). This distributive goal is again a distortive stand that can introduce extensive inefficiency in the system.

An effective procurement policy designed to support prices at the harvest season will automatically benefit small producers without any need for introducing this consideration in the objective function of the policy. The emphasis should be on the effectiveness of procurement in supporting prices during the harvest season, when most small producers sell their products. Small producers in particular, and all farmers in general, do not sell directly to government procurement centers. Their dependence on the market implies that unless market prices are influenced by procurement, they are not likely to derive benefits from the policy.

The foregoing discussion leads to the conclusion that price support in the harvest season is the single objective that should guide the procurement policy of the government. This price support in the harvest season and the public sale of grains in the peak price season constitute a price stabilization mechanism in the Bangladesh foodgrain market. Of course, there could be other more efficient systems than this mechanism. For example, the scheme of a variable tax and subsidy in border trade is believed to be another option. This paper is not intended to explore these alternatives. In the price stabilization mechanism discussed here, the determination of procurement price at the level of price support is a critically important task. The procurement policy is too often described as an instrument for providing incentive prices to producers. This is obvious and understandable. However, what is not so obvious is the degree of incentive. How much incentive is appropriate and what constitutes the criteria of appropriateness? This question is examined in the next chapter.

4. CRITERIA FOR DETERMINING PROCUREMENT PRICE

The following considerations are particularly relevant to the choice of criteria for determining the procurement price:

- A higher level of incentive through a higher procurement price will require more public resources (in the form of subsidies) unless the sale price of the procured grains can be increased at an equal rate with the procurement price. This is the direct cost of incentives through price support.
- The indirect cost of providing incentives to farmers could, however, be potentially more significant than the direct cost. A higher price for rice will attract resources, including land, from other crops to rice. Therefore, this reallocation of resources from other crops to rice may imply no net social gain, or even a loss to the overall economy. This is a serious social cost.
- Sustaining the domestic price of foodgrains at levels that deviate from the world price invariably implies a substantial indirect cost. The world market provides an opportunity to consider either importing grains or expanding exports, depending on whether the country is a deficit or a surplus producer. Therefore, deviation from the world price causes a distortion in domestic prices that cannot be sustained for any prolonged period without a heavy burden on public resources.
- The domestic market price is of course the most immediate concern and therefore relevant to the determination of procurement price. Because most farmers and consumers trade in competitive foodgrain markets, incentives through public intervention are generally provided through the influence of public operations on market prices. If the domestic price is considerably out of line with the world price or the cost of production, an adjustment is necessary but often is possible only over a period of time rather than immediately. The government's concern for incentives to producers is often matched by an equal or even larger concern for consumers. The reflection of these two concerns is the open market public sale (OMS) for bringing down prices in the peak price season and public procurement for boosting prices in the harvest season. Therefore, public procurement in conjunction with public distribution of foodgrains is basically a mechanism of price stabilization in the foodgrain market. In this task of price stabilization, the procurement price and open market sale price play critical roles

and must be linked for two reasons. First, if the gap between procurement price and open market sale price is reduced too much, it causes reduced public revenue and hence larger subsidy costs. Second, and more significant than the first, is the effect of public action on private trade. If the price band (the difference between procurement and the open market sale price) is made narrower and the policy is made effective, then the scope of private trade diminishes because private trade operates on the profit margin implied in the difference between harvest and peak season prices. In such a situation, government operation may simply replace private trade without much of an impact on market prices. Procurement and open market sale prices cannot be set in isolation from market conditions and market prices. A procurement price much higher than the market price introduces considerable scope for rent-seeking and corruption. The case is similar when the open market sale price is much lower than the peak season market price. Therefore, some sort of assessment of the likely market conditions and price levels is required for the advance determination of a procurement price.

The foregoing discussion indicates the need for three plausible criteria when determining procurement price: (1) Cost of production as a check on the rate of return to land and farm entrepreneurship; (2) world price as a check for not allowing domestic prices to be distorted far from prices that would allow the government to take advantage of opportunities provided by the world market; and (3) market prices for ensuring feasible and efficient operation of the public system in stabilizing domestic prices in the short run. Whenever there are multiple criteria for deciding on a single parameter (that is, the procurement price), there is a potential for conflict. Different criteria may indicate different levels of procurement price. How can conflicts among these criteria be reconciled if there are any? This question of reconciliation will be examined later when the estimates of procurement prices derived from the three criteria are compared.

COST OF PRODUCTION CRITERION

The cost of production is defined as the cost of producing a unit of rice (or any output). It should not be confused with the concept of cost of production per unit of land (that is, per acre cost) so widely prevalent in general discussion. The former is the relevant concept for the purpose of pricing. The cost of output per unit can easily be derived by dividing the cost of production per acre by the yield of rice per acre.

Most professional economists object to the use of cost of production as a criterion for determining the level of procurement price. The following objections are quite typical in price policy literature (Mellor and Ahmed 1988).

- The criterion of cost of production is oriented toward safeguarding the gains of private producers. It does not cover the gains or losses from the social point of view. For example, the cost of producing rice could be so high that it would be socially profitable to import rice and use the resources saved to produce other goods and services. The cost of production criterion does not allow this possibility.
- The cost of specialized resources (for example, land rent) is determined by demand and therefore is affected by product price. Accommodation of this cost in fixing the price involves circularity. Every time the product price is raised, the cost of these resources will also rise, and subsequently, the administered price will have to be raised.
- Including rent in the cost of production does not reflect the opportunity cost of land to society. The case is similar for family labor that will not be offered to the market if the commodity in question is not produced.
- Since there are great differences in costs among farmers and regions, the choice of farmer groups and regions whose cost is to be covered by the procurement price will be arbitrary. An arbitrary choice of a cost estimate may generate enormous problems of interregional or intergroup income distribution.
- The cost of production argument implies that the procurement price should be lowered as technological diffusion progresses, because, by definition, technological progress means a proportionately higher rate of increase in yield than the increase in cost of production per acre. On the other hand, technological opportunity generally advances the comparative advantage that may disappear under the influence of reduced price.

In spite of so many objections to the use of cost of production, its dominance in the debate on public pricing is remarkable. This is because it serves as a layman's logic and perception of fairness in pricing. An ordinary man tends to compare the price with the cost in order to evaluate a fair rate of return. Therefore, this criterion is popular in political debate on pricing but of little use in guiding the determination of price, as will be shown later. The procurement price and the procedure involved in arriving at this amount by using cost of production criteria are shown in Appendix 1.

WORLD PRICE CRITERION

The world price criterion is designed to maintain a price level that would prevail in the absence of any government control. However,

world price fluctuates very widely, and few developing countries can afford to absorb such wide fluctuations in their domestic prices. The instability of world prices is believed to be one of the main reasons for the government to design some sort of intervention in the external foodgrain trade. Given this fact, the use of the world price criterion implies an attempt to keep domestic price in line with the trend of world prices and not with the actual prices of any particular year.

Application of the criterion of world price requires a prejudgment of whether the country is an importer or exporter of the commodity, that is, rice in the present case.

Bangladesh is currently self-sufficient in rice; the country neither imports nor exports rice. Occasionally, surplus domestic rice production has had a fluctuating impact on prices in the domestic rice market. While the country has not attained an exporter status in rice, it appears to be heading in this direction even though it has been a net importer of foodgrains, mostly wheat. An analysis of rice production and domestic demand for rice indicates that the recent experience of only a marginal surplus of rice, along with an increasing demand for imported wheat, may worsen in the future (Goletti and Ahmed 1990). The world price on the basis of imports is much higher than the world price on the basis of exports. In consideration of Bangladesh's status in rice production and trade, the average of import and export parity prices has been used to arrive at the border price of rice that is used as a basis for the procurement price. Appendix 2 provides the basis of this ad hoc procedure and the details of the estimates.

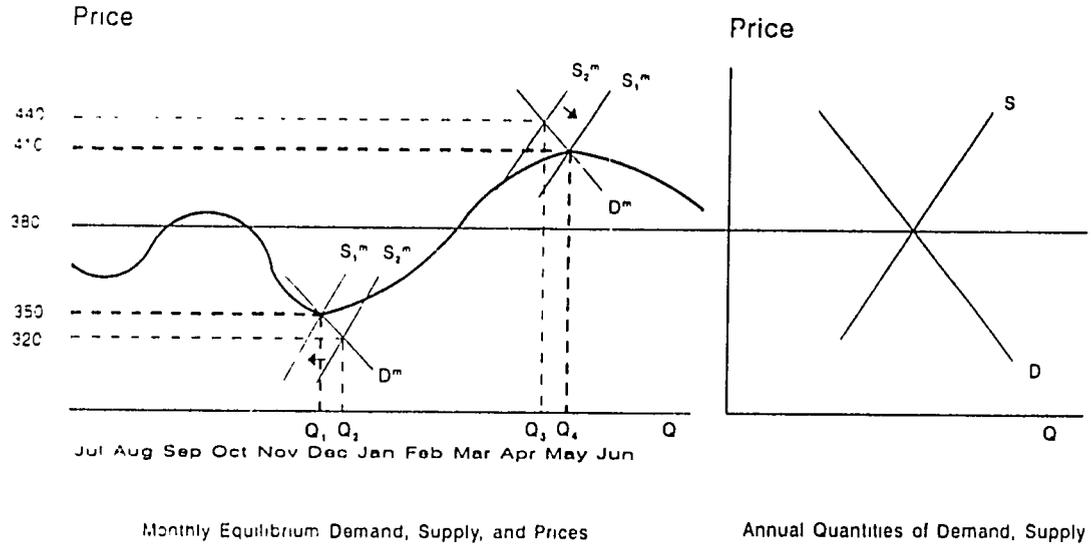
DOMESTIC MARKET PRICE CRITERION

This criterion is important for operational purposes as well as for the stability of the government's budget. A procurement price way out of line with the market price generally breeds inefficiency and destabilizes the budget. Moreover, when price stabilization is one of the primary objectives of the Public Food Distribution System (PFDS), pricing practices cannot be devoid of considerations of market prices. The procedure followed in applying this criterion involves an assessment of the likely market price situation in the coming season or year. Then the procurement price is determined as a mechanism of price support (that is, as a floor price) that is consistent with a flexible price band necessary to protect private traders in the market. The details of this procedure and the estimated procurement price for 1991/92 rice crops are presented in Appendix 3.

The procedure outlined in Appendix 3 provides a complete framework for determining both the procurement price and the open market sale price necessary to stabilize prices. This is further shown in a diagrammatic form in Figure 1.

The right-hand side of Figure 1 shows the annual average price (at the farm/primary market level) predicted for the year under consideration and the equilibrium point between the annual supply of and demand

Figure 1—Price stabilization framework



for rice. This price is Tk 380 per maund. This average is further disaggregated into monthly prices, assuming that the monthly price fluctuations follow a normal pattern that allows a margin (the difference between harvest and peak season prices) for private traders to earn a normal profit from trading. This disaggregation into monthly prices is shown in the left-hand side of the figure. In this diagram the loci of monthly equilibrium points (prices) are traced in the bold line. This curve shows the peak season price of Tk 410 in May and the harvest season or slack season price of Tk 350 in December-January. A price band between 410 and 350 ($380 + 30$ and $380 - 30$) is explicit in the illustration. The peak and slack price situations could arise in other months also; for example, a slack price situation may occur in July-August when the boro crop is harvested. The numbers used are somewhat hypothetical but very close to estimated numbers presented in Appendix 2.

The task of the government stabilization policy is to maintain prices within this band (note that the band could be larger or smaller depending on the government's tolerance of instability—but such deviations have costs). Suppose, because of a good rice crop, market supply in December/January increases from Q_1 to Q_2 and the price falls from 350 to 320. The task of procurement will be to push up the market price to 350 by public procurement equivalent to the difference between Q_2 and Q_1 . In Figure 1 the increased supply is shown as a shift of supply curve from S_1^m to S_2^m , and the procurement is shown to push the S_2^m back to S_1^m . In the process, price also goes up from 320 to 350. A similar but opposite shift of market supply curve is shown in May when rice prices generally peak in Bangladesh. Such a shift could take place as a result of a poor harvest. The task here is to sell in the open market from

public stores in order to bring the price down from 440 to 410. The quantity required for open market sale is $(Q_4 - Q_3)$.

It may appear that so long as prices remain within the band there would be no need for any government activity in the market. This is largely true. However, the model shown in Figure 1 is an average for the whole country. It does not show any regional or locational behavior of prices. In reality there could be some locations or regional markets where prices would go beyond the band even though the average would remain within the band. Such deviations would generally be minimal. Therefore, the framework implies quite a small extent of public intervention (procurement or sale) in normal years.

The model is an abstraction of what the public food management program attempts to achieve through its sales and purchases. These attempts would be more effective if the government treated the floor price as the support price for procurement. In fact, the term "support price" should be substituted for procurement price in government papers. This implies, however, that, in order to support the market price in harvest season, procurement should take place through open-market tenders (discussed in a later section) so that the procurement price reflects the prevailing market price. The precaution required in switching to such a procedure is that the procurement operation should not exceed the point that causes the market price to go above the support price.

5. ESTIMATES OF PROCUREMENT PRICE FOR 1991/92

Estimates of the procurement price for the 1991/92 rice crops, on the basis of the three criteria discussed in the previous section, are shown in Table 1. Before commenting on these estimates, a short digression is warranted. The estimates of procurement price are meant for the whole country—a panterritorial price for the procurement program. Obviously, the extent of incentives implied in these estimates will vary from region to region. Farmers in the surplus districts and in infrastructurally backward areas, whose market prices generally tend to be lower than prices elsewhere, would receive higher incentives from this procurement price than other farmers. The administrative nightmare involved in implementing a number of procurement prices based on location considerations is frightening enough to exclude such an approach from consideration. This panterritorial pricing has, however, important implications that cannot be easily brushed aside. One of the implications, relevant to public management of foodgrains, is that procurement will be relatively concentrated in the surplus districts. Consequently, the government will be increasingly involved in the spatial movement of foodgrains as the procurement price increases. This may increase the cost of the public food distribution system unless the cost of transporting public foodgrains can be kept within the limit of comparable costs in private trade. This topic will be revisited in Chapter 7.

In Table 1, the cost of only aman and boro high-yielding varieties (HYVs) is included. The cost of local varieties and aus rice is not considered in determining procurement price. Price policies influence

Table 1—Estimated procurement prices for 1991/92 rice crops

Criterion	Estimated Procurement Price of Rice	Estimated Procurement Price of Paddy
	(taka/maund)	
Cost of production		
Aman HYV	292	194
Boro HYV	310	206
World price	308	205
Market price	346	230

Source: See Appendixes 1, 2, and 3 for detailed procedures.

Note: Cost per maund is on a cost C basis plus a normal profit margin. The cost of land rent has also been included in this cost estimate. The basis of cost C is outlined in Appendix 1.

resource allocation through their impact on the margin of change. That is why economists argue that it is the cost of production at the margin and not the average cost that is relevant in using production cost as a guide, if such guidance is at all necessary. The margin of change in rice production in Bangladesh is the area where HYVs are being introduced, replacing local varieties. In the case of aus, it is the conversion of aus area into boro HYVs, under the influence of irrigation-HYV technology, that represents the margin of change. Therefore, the production costs of aman and boro HYVs appear to be the relevant rice costs for this exercise.

It can be seen in Table 1 that the estimates of procurement price based on the three criteria differ rather widely. The cost of production criterion gives an estimate of Tk 301 per maund (average of aman and boro), the world price criterion generates the estimate at Tk 308, and the domestic market price criterion shows the estimate at Tk 346. How can one be chosen from this wide range? Even though the task of making a choice is made difficult by the use of three criteria, they provide some indication of the needed direction of change in procurement prices. The production cost estimates provide evidence that the absolute degree of profitability in production of rice is quite high. This estimate incorporates a profit of 50 percent even after the costs of land rent and family labor are included (see Appendix 1 for details). The estimate based on the world price criterion is not significantly different from the estimate based on production cost. However, the estimate based on the market price criterion is substantially higher than either of the other two estimates. It reflects the fact that the domestic rice price in Bangladesh has been higher than the world price in recent years and rice producers are already enjoying considerable incentives. A downward adjustment in domestic prices to bring them into conformity with the world price regime is therefore warranted.

The current procurement price of rice is roughly Tk 362 (Tk 240 for paddy). This is significantly higher than all the estimates shown in Table 1. However, even though it is necessary to adjust procurement prices downward, full adjustment may not be possible in the coming crop year. Such adjustments will require trade liberalization that may not materialize within such a short span of time. In the absence of these necessary changes, a procurement price that is out of line with the domestic price regime will be administratively difficult to implement. With this consideration in mind, a procurement price of about Tk 345 for rice and Tk 230 per maund of paddy is suggested for the 1991/92 crop year.¹

There are three important implications for setting a procurement price way above the market price in harvest season:

¹ A postscript is in order. The recommendation of this paper was discussed in the cabinet of ministers. The new government did not want to reduce the procurement price and thus appear to be insensitive to the cause of farmers. However, the paper's recommendation and analysis were effective in blunting the strong move to sharply raise the procurement price. A token increase in procurement price (by Tk 5 per maund) was therefore approved by the cabinet for the 1991/92 crop year.

- A wide gap between procurement price and market price may encourage rent-seeking tendencies. This may take many forms. Besides the usual way of selective purchase and sharing in the price gap, there are other potential ramifications. For example, if the procurement price is higher than the price in the rural rations, foodgrains from rationing may in turn be sold to government agents under the procurement program. It is possible to make money simply by adjusting book accounts without any physical exchange under the two programs.
- If the procurement price is substantially higher than the market price, a large quantity of grain will be offered to the government. If the government has enough finances to take as much grain as offered, private traders will be discouraged from remaining in the stockholding business. This implies the substitution of government trade for private trade.
- On the other hand, if the government does not have the financial and physical resources to buy whatever quantity is offered, as is often the case, the program becomes ineffective. Thus an environment is created for accusing the Ministry of Food of having no interest in price support.

Setting a procurement price closer to the market price is therefore a critical requirement.

Although this paper is concerned with the procurement price of rice, the question of a procurement price for wheat is quite relevant. The wheat procurement price is currently set at about 60 percent of the rice procurement price. In the past, this ratio was about 0.7; it is roughly the ratio in the world market also. In view of the prevailing situation, there are grounds for setting wheat prices at about 70 percent of those for rice. The emerging food situation in the country is likely to be dominated by increasing domestic production of rice but an increasing deficit in wheat. This situation warrants an increase in wheat price relative to rice in the domestic market.

6. IMPLEMENTATION PROCEDURE AND PROGRAM EFFECTIVENESS

The effectiveness of the procurement program in achieving its objectives at least cost depends very much on how the Food Department goes about it. The way the program operates involves a number of considerations centering on (1) form of grain, (2) location of purchase, (3) mode of purchase, (4) timing, (5) scale of procurement, (6) mode of payment, (7) mode of quality control, and (8) the degree of complementarity with private trade. These considerations perhaps deserve more analytical attention than those for deciding the level of the procurement price. Although the scope and the mandate of this paper do not include a comprehensive treatment of these operational issues, the purpose of this exercise will not be well served without some discussion of implementation procedures. The implications of cost-effective procedures for the budgetary burden of the government are enormous.

The cost of food subsidies weighs heavily on [the] government budget. After averaging 2.8 billion taka (\$70 million) per year during the 1980's, losses in the PFDS exploded in 1990. In that year alone, total subsidies jumped to 11 billion taka (\$280 million), an amount equal to 60 percent of the government's taka contribution to the Annual Development Plan. Although the drain has returned to its normal level of about 3.5 billion taka (\$90 million), the concern of the government and donors to this high level of cost is quite intense. (IFPRI 1991).

FORM OF GRAIN

Before 1989/90, most of the grain procured was in the form of paddy (unhusked grain). Since 1989/90, the bulk of the purchase by the government has been in the form of rice (processed). It should be noted that when grains are bought in the form of paddy, the government has to further process the paddy before the grains can be distributed in the consumable form of rice. Therefore, the public has to pay for the additional task of processing when grains are purchased in the form of paddy. Transporting paddy to mills for processing, arriving at a correct rice-to-paddy milling ratio, negotiating a correct price for the milling function, transporting the milled rice back to public godowns, and delivering rice with the correct weight at public godowns all represent a complicated series of management tasks. Only the private sector can be expected to accomplish these tasks in an efficient way. Since 1989/90, the procurement program has purchased rice from millers through

"millgate contracts"; purchase of paddy constitutes a small portion of total grain procurement (more on this issue in a later section). It is estimated that about 90 percent of procurement was in the form of rice in 1991/92.

LOCATION OF PROCUREMENT

The government's purchase of grains is concentrated in the northwest region of Bangladesh, while its distribution of such grains is primarily limited to other regions south and east of the Jamuna River, especially in the large urban centers of Dhaka and Chittagong (Table 2).

It is natural that procurement will be proportionately high in surplus districts (northwest region) and distribution high in deficit districts (eastern region) (Table 2). But this implies that the government is again obligated to transport grain from surplus to deficit areas. It is now known that the cost of storage, handling, and transport by the Directorates of Food (the public agency for food procurement and distribution) is more than twice the cost in the private sector. The Directorates of Food pays double the market price for standard B, twill gunny bags—Tk 29 instead of Tk 15 (Rahman 1992). For transport, they pay 40 to 100 percent more than the private sector (World Bank 1992). Moreover, transit losses for publicly handled grains are notoriously high, and these losses are not reflected in the operational costs of the Food Department.² The question of transferring the function of moving foodgrains from the public to private traders is obviously very important. A mechanism of procurement through tenders in order to achieve this purpose is suggested in Chapter 7.

Table 2—Public procurement and distribution of rice, by region, 1990-92

Region	Procurement	Distribution
		(percent)
Rajshahi	91	21
Khulna	7	15
Dhaka	2	39
Chittagong	0	25
Total	100	100

Source. Director General of Food, Bangladesh.

² One of the major difficulties in accounting is an inadequate number of account headings and the failure to reconcile accounts. There has not been a reconciliation of the accounts for the Director General of Food in the last eight years (World Bank 1992).

MODE OF PURCHASE

There is a general belief in the minds of policymakers that incentives to farmers from the procurement program depend on direct purchase from growers. That is why the program was organized to purchase paddy directly from farmers through thousands of purchasing centers all over the country. However, real-world experience has shown that farmers do not generally sell to government purchasing centers. The bulk of the purchase comes from traders. A number of studies have shown that a preponderant share of the grain procured is obtained from traders (World Bank 1979; Osmani and Quasem 1985). IFPRI's survey in 1989/90, when procurement volume was quite high, showed that in seven important surplus districts, only 2 percent of the farmers sampled sold to the government and on average sold only 1.3 percent of their marketings to the government. Therefore, incentives to farmers depend on how much effect the procurement program can exert on market prices. The volume of purchase and the purchase mechanism that encourages competitive bids for supplies are critical factors for an influence on market prices. The present mechanism has too many flaws (see Box 1).

The view that farmers do not benefit from procurement when purchases are not made directly from growers is generally wrong and really reflects a lack of faith in the strength of market integration. Of course, where markets are fragmented and signals do not rapidly pass from one market to another, the effect of procurement from traders is

Box 1—A Typical Newspaper Report on Public Procurement

New crop coming to market but farmers are being deprived of fair prices.

Lalmonirhat, 29 June 1992

Farmers in this district have harvested a bumper IRRI-boro rice crop this year, but the producers of paddy are not receiving fair prices for their product. It was learned through interviews with a number of farmers that they had put an extraordinary amount of effort into raising a bumper crop. They borrowed extensively from moneylenders and traders in order to pay for fertilizers, pesticides, water charges, and electricity, and applied extraordinary measures to protect their crops from the vagaries of nature.

They were expecting a return commensurate with their efforts. Farmers have few alternatives other than to sell their paddy after harvest in order to repay loans and meet various cash needs. Even though the government has a policy of procuring paddy from farmers at fair prices, the officers in charge of public food godowns in Lalmonirhat are refusing to purchase from farmers on various pretexts. The officers are colluding with a class of traders who are selling paddy to public authorities.

The collusion between millers and traders on one hand and procurement officers on the other is keeping farmers from getting the government-declared fair price. Even though the public procurement price is Tk 240 per maund, the public procurement agents, in collusion with millers and traders, are paying farmers only Tk 200 to Tk 210 per maund of paddy. Farmers are appealing to public authorities to take urgent measures to stop these unfair practices.

Source: Dainik Khabar (newspaper), 29 June 1992, Dhaka, Bangladesh (translated from Bengali into English).

not likely to be passed on to growers. However, rice markets in Bangladesh are normally not very fragmented. Studies have shown that in normal years, and even in years with moderate natural and man-made calamities, rice markets perform reasonably well. It is only in extremely abnormal situations caused by natural or political factors that markets are found to exhibit the attributes of imperfection and fragmentation (Ahmed and Bernard 1989; Ravallion 1987). IFPRI is conducting a market study to examine this and a number of other market-related issues. Preliminary findings from this study also support the position that purchases in one place will affect prices in other markets. The critical factors are again volume and competitive mode of purchase. The current practice of millgate contracts is equivalent to bilateral negotiations between the purchase officer of the Food Department and the mill owner. In any such bilateral negotiation, the amount of rent-seeking by both the purchase officer and the mill owner is large. Such negotiated transactions cannot affect market prices as much as a competitive process of procurement. The millgate contract being a predominant mode of procurement, it warrants a little more elaboration.

Millgate Purchase

A millgate contract is a complicated mode of procurement with a wide range of arbitrariness. It is a package contract between the government and a rice mill owner. This package includes (1) purchase of paddy, (2) milling this paddy into rice, and (3) transporting the rice to a designated public store. A number of mills are engaged through a composite contract to procure paddy for the government and mill the paddy. The miller has to put up to 60 percent of a value equivalent to his 15-day milling capacity for paddy as security in the form of a bank guarantee or other financial instrument such as a savings certificate. Upon completion of the paperwork, the miller can procure paddy from farmers or the market. An officer of the Director General of Food then inspects the quantity and quality of the grain, and the mill contractor is paid for the value of grain equivalent to 15 days of processing capacity. This payment is made through a weight, quality, and stock certificate (WQSC), which is redeemed at a commercial bank. The point to note is that the milling capacity is determined by inspectors of the Director General of Food prior to contract award. After the contract is awarded, the miller is bound to deliver fair average quality (FAQ) rice within 15 days. The contractor then again procures paddy, and the cycle goes on until he is no longer capable of supplying paddy at the procurement price.

The millgate purchase mechanism depends on three elements: (1) processing capacity of the mill (parboiling, drying, and milling), (2) putting up the requisite security, and (3) delivery of FAQ rice on time. The entire system has a number of weaknesses, which are summarized below.

Processing Capacity

There is no objective way to precisely determine processing capacity, especially drying capacity. A measure of the mill yard may provide some idea of the contractor's drying capacity, but because sun-drying is the only available method, drying capacity is very dependent on weather factors. Therefore the use of processing capacity as a basis for a purchase contract is rather weak and can be abused with impunity. There is a general tendency everywhere to overstate milling capacity in the contract in order to allow subcontracting, and to purchase rice from the market and supply it to food godowns, thus exploiting the rent components of the contract.

Supply Time

While the contract stipulates a maximum time for delivery, it is silent on the minimum time. A miller may deliver rice any time within the contractual 15-day period and still be entitled to another payment of his contracted quantity by WQSC, which, in effect, is a cash payment from a designated bank. It is not unusual for mills in the northwestern region to receive several payments within the 15-day period. Theoretically, this ought to be impossible because the processing capacity cannot be exceeded, but in practice it occurs.

Accounting Flaws

With the issue of the WQSC, the paddy thus bought is entered in the Food Department's stock book, even though the paddy has not been physically received. At the same time, the officer in charge of the public godown shows this quantity of paddy as delivered to the mill for processing. This process is simply an accounting adjustment without any movement of commodity. Of course, the public godowns ultimately receive rice from such millers. Nevertheless, it is obviously a bad accounting principle to enter into books an item that has not been actually received. This seemingly simple process has far-reaching consequences in stock accounting and audit. As a matter of fact, nobody knows the exact quantity of rice in a stock, and auditing the stock book becomes almost irrelevant. The paddy-to-rice conversion factor is variable, and this makes exact determination of rice stock a matter of guesswork.

Advance Payment

The system works on advance payment. There is no way to determine ownership of paddy at the miller's store. It is quite plausible, and in fact a common practice, for a miller to (1) keep stock belonging to other traders, (2) show the same stock time and again to food officials in order to get the WQSC, and (3) thus receive payment before he even goes to market to purchase rice to supply to the government. This practice enables the miller to supply rice to the government several times within a 15-day contract period.

Quality and Quantity Check

Theoretically, the Food Department buys FAQ paddy. Unless the quality of paddy is good, the quality of the resultant rice cannot also be good. In practice there is little or no check on the quality of paddy in millgate purchases. This is a logical outcome of the system: The final delivery is taken in the form of rice, whereas the quality check is stipulated for paddy. As for the check on quantity, it is physically impossible to weigh the entire contracted quantity in a mill. The Director General of Food has more than 1,300 contract mills, mostly in the northwestern region. In a single district there are hundreds of husking mills to be regularly checked for quality, quantity, and state of operation; these tasks are stipulated in contracts. These impractical stipulations virtually ensure the neglect of supervisory responsibilities.

That the process of millgate procurement is really as abused as the foregoing statements illustrate is also borne out by information from various other sources. The poor quality of procured rice in public godowns has been witnessed and recorded in a World Bank report (1992). The rapid deterioration of grains in public godowns is a fact widely known in the government. Adverse and nagging press reports on this subject are frequent. Some statistics provided in Table 3 indicate that the government has yet to recover large quantities of rice from millers. This table shows that out of 17,681 metric tons of paddy issued to mills against an expected delivery of 11,788 tons of rice from the mills, only 1,043 tons of rice were received by the government during the week ending 20 November 1991. The value of the outstanding rice is Tk 107.45 million—not a small figure in the present context. It should be noted that rules stipulate that all deliveries by mills must be completed by 15 October because the following procurement season begins on 15 November.

Table 3—Weekly milling status report for 14-20 November 1991

Region	Quantity Issued to Mill (Paddy)	Quantity Received from Mill (Rice)	Expected Recovery (Rice)	Mill Balance (Rice)
(metric tons)				
Rajshahi	16,684	447	11,123	10,676
Khulna	0	0	0	0
Dhaka	697	302	465	163
Chittagong	300	294	200	-94
Total current week, cumulative	17,681	1,043	11,788	10,745

Source: FAO Reorganization Project, Ministry of Food, cited in M. Rahman, "Available Procedure and Open-Tender Mechanism of Procurement," Bangladesh Food Policy Project (International Food Policy Research Institute, Dhaka, 1992). Mimeo.

The story of abuse through the millgate procurement system is concluded by providing a real-life case history collected during IFPRI's field survey of rural rationing. This is presented in Box 2 and shows how collusion among millers, ration dealers, and food officials beats the system, exploiting the weaknesses of the procurement and targeted distribution programs.

Most farmers sell their rice in the market, and the procurement program contributes to incentives through its impact on market prices. The implementation procedure is critically important in producing this

Box 2-A Shrewd Way of Beating the System

During our survey, the owner of a rice mill in Bogra District revealed an ingenious method of abusing the Palli Rationing program through the government rice procurement system. Bogra is one of the largest rice procurement areas in the country. The rice-miller, an apparently wealthy and educated man, confessed that he was involved in the deal, and described the method as follows.

- a. In the procurement program, the government buys rice through a system known as the millgate purchase contract. The contract rice-miller purchases paddy, and after milling the paddy, supplies rice to the government at a fixed price that includes the milling charge (Tk 10,544 per metric ton during the survey). The officer-in-charge of the LSD and the Upazilla food controller sign and issue a Weight Quality Stock Certificate (WQSC) to the contract miller to supply rice. The miller produces the WQSC at a designated bank and receives cash payment for the supplied rice.
- b. In this rent-seeking process, however, a portion of the millgate purchased rice is not supplied by the miller. Instead, this quantity is shown in the allotment of rice in the PR program. A delivery order is issued by the food officials to the PR dealer for his full allotment of rice. The PR dealer pays the subsidized price for the full allotment, but receives a lesser quantity of rice. Later, the PR dealer gets back the money he paid for the quantity he did not receive.
- c. In this process, the government pays a

price of Tk 10,544 per metric ton for a quantity of rice that is not received. In the official record the same quantity is shown as delivered to the PR program at a subsidized price of Tk 7,340 per metric ton. The difference between the millgate purchase price and the PR issue price (i.e., Tk 3,204 per ton) is shared by the parties involved in the deal.

An example will give an idea about the magnitude of profit that can be made through this process: the monthly officially recorded PR rice offtake from a typical LSD in Bogra is about 98 metric tons of rice. If one-half of this quantity disappears in the process described above, then about Tk 157,000 can be earned in a month in one LSD during procurement seasons.

- d. The government also pays for other bills arising from this fictitious transaction. These bills are:
 - i) Carrying charge of rice from the mill to the LSD (about Tk 3 per ton per kilometer) paid to the carrying contractor (for the rice that was not carried);
 - ii) Handling charges at the LSD (about Tk 2 per bag of rice) paid to the handling contractor to receive the millgate purchased rice and deliver the PR rice (for the rice that was not handled);
 - iii) Payment for shortages allowed for storage loss (for the rice that was not stored).

These bills, arising from the nonexistent transaction, must be charged to the government to keep the accounting in order.

impact. This procedure should be transparent and effective enough to create expectations among traders that a fall in prices will be prevented. Current procedures involve almost a bilateral negotiation between a Ministry of Food officer and a trader. To make the procedure more competitive, procurement through open tenders may be seriously examined.

The impact of open-tender procurement on market prices is likely to be much sharper and more dramatic, for a given quantity of procurement, than the impact under the current procedure. A brief outline of the open-tender purchase procedure is presented in the next chapter.

7. PROCUREMENT THROUGH OPEN TENDER

Public marketing of foodgrains, if unavoidable for food security reasons, must achieve its purpose through the utmost efficiency. This implies a purchase mechanism that complements the market instead of substituting for the market. The open-tender procurement mechanism is one such mode of purchase. It involves inviting private traders to submit competitive bids to supply grains of specific quality and quantity at a selected location and at a quoted price. The invitation itself creates a pressure on market expectation, thereby producing a price support effect. The transparency of the procedure inhibits rent-seeking in public management. If it is appropriately designed, it shifts the functions of processing, storage, handling, and transportation from public agencies to private traders. Because of its time-honored usefulness, this procedure has become a statutory mechanism in many public procurement operations.

FACTORS IN DESIGN

A number of critical factors must be appropriately incorporated in the design of open-tender procurement in order to fully exploit the potential cost-effectiveness of the mechanism. These factors include (1) form of grain, (2) packaging, (3) delivery points, (4) pricing guideline, (5) quantity and quality control through inspection, (6) time schedule, and (7) mode of payment. Some of these factors were raised in the preceding section. However, it is necessary to briefly elaborate on them here.

Procurement of Rice Instead of Paddy

The pros and cons of procuring rice instead of paddy were mentioned earlier. The task of converting paddy to rice is shifted to the private sector if rice is to be procured.

Packaging

Packaging of rice in suitable gunny bags should be a requirement of the tender document so that the government will not have to purchase

This chapter as well as the previous one draws extensively on the study by Rahman (1992). Rahman conducted the study as a consultant to IFPRI in order to examine the pros and cons of procurement of rice by the Ministry of Food through the open-tender mechanism, which was introduced in the 1991/92 season on an experimental scale.

gunny bags to package rice. The gunny bags for the tendered rice should conform to the Bangladesh Standard and Testing Institute (BSTI) BDS 906:1979 specification issued in June 1982.

Delivery Points

Successful tenders should deliver rice to public godowns in central distribution locations, namely, in the regions of Dhaka, Chittagong, and Khulna. This condition in the tender document is tantamount to shifting the major transportation functions from the public to the private sector.

Pricing

A pricing guideline for open-tender procurement means asking for a price quotation from private traders for a specified supply at designated delivery locations. The private traders will be completely free to choose their locations of purchase. The support price determined in advance should be mentioned in the tender notification, with a clear indication that the government reserves the right to reject any tender with a quoted price above the support price. Thus the support price serves as a guide to open-tender procurement and ensures the price-stabilization objective of the government.

Quantity Procured

The quantity of open-tender procurement should be consistent with the aggregate market supply and price regimes. In the discussion on determination of procurement price based on market price criterion, it was shown how aggregate supply and prices are related. From that relation, it is possible to derive an approximate estimate of procurement quantity after taking crop condition into consideration.

This procurement quantity should be the guide for the open-tender operation. However, it is not necessary to impose any quantity limitation in the tender notification, even though the government will have to be guided by a quantity objective that is consistent with stabilization of prices.

Quality Control

Control of the quality of rice through inspection at delivery points is an important requirement for an efficient operation. The present practice of the Food Department includes purchase on the basis of a quality standard commonly known as fair average quality (FAQ) and this standard is supposedly maintained through inspection by a food inspector from the Directorate of Inspection and Control. The FAQ standard specifies (1) moisture content (maximum 14 percent); (2) foreign matter (maximum 0.5 percent); (3) immature, discolored, dead, and damaged kernels (maximum 0.5 percent); (4) admixtures of varieties

(maximum 10 percent); (5) broken kernels (maximum 20 percent); (6) chalky and white belly kernels (maximum 6 percent); and (7) red and unmilled rice (maximum 6 percent). This specification does not clearly define the terms; no standard method of testing and sampling is prescribed, and the units involved are often ambiguous. In practice, this device of quality control is known to be ineffective in achieving its purpose. The practice of in-house inspection has further made the FAQ standard operationally meaningless. On the other hand, the specification developed by the Bangladesh Standard and Testing Institute for rice is generally considered to be appropriate for rice procurement by the Food Department (Rahman 1992, 24). This expert on rice milling has suggested that one of the grades of BSTI Standard 952 BDS 952:1981 for rice be adopted by the rice procurement program. In addition to instituting this standard, inspection responsibility should also be shifted to the private sector. There are private inspection agencies available in Bangladesh that can be used to inspect rice under the open-tender procurement at the suppliers' cost. These agencies would provide a better guarantee of weight and quality for publicly procured rice.

Schedule

The question of a schedule for open-tender procurement has been examined. A suggested schedule presented in Table 4 has important implications for producing an exceptional effect on market prices. Because tender notice is designed to float before the harvest, traders are expected to probe into the prospects of crop output and likely market prices. Traders would also be able to plan their financial resources early in the market period. Once a tender is accepted, the traders' risk on price uncertainty would be minimal. This process would therefore stimulate a vigorous competitive environment in rice markets.

Payment

The mode of payment to traders by the procurement agency could sometimes entail high transaction costs. The present procedure of payment for millgate contract procurement involves the weight, quality,

Table 4—Time schedule for open tender

Crop	Time of Floating Tender	Last Time for Submission	Evaluation and Award of Contract	Last Delivery Date
Aman	Mid-October	Mid-December	1st week of January	1st of May
Boro	Mid-March	Mid-May	3rd week of June	1st of October

Source: M. Rahman, "Available Procedure and Open-Tender Mechanism of Procurement," Bangladesh Food Policy Project (International Food Policy Research Institute, Dhaka, 1992). Mimeo.

and stock certificate discussed in Chapter 6. In effect, this mode of payment results in giving out money before the goods are received. It is a sort of credit to contractors at government cost. The interest cost of public procurement is reported to be quite high, although a precise estimate is hard to obtain. Introducing additional options in the mode of payment has been suggested. An internal letter of credit opened in any bank by the Directorate General of Food under the open-tender system of procurement is considered to be an option that can reduce the interest costs associated with present modes. Moreover, a bank loan against an internal letter of credit can be quite effective in increasing the access of traders to financial resources. The cost and risk associated with such credit will be borne entirely by borrowers and not by the government.

In general, there is a perception that the financial system of the country discriminates against grain traders. Such discrimination is reflected in restrictions on credit to grain traders in various forms. Government policies on market liberalization and promotion of private trade are likely to founder in the absence of an effective liberalization of financial markets, particularly some positive steps to enhance the access of market intermediaries to institutional credit.

Procurement through open tender has been suggested to the government, and the government has attempted to adopt the policy on a limited scale. Experience gleaned from this initial attempt indicates that the Food Department encountered a number of unforeseen problems. IFPRI has evaluated these problems and produced a policy brief indicating how to proceed in the future. A training program has also been planned to sharpen the nuts-and-bolts issues in open-tender procurement. It is hoped that as experience with open-tender procurement matures, a successful transition can be made from the current procedure.

8. CONCLUSIONS

It is visualized that within the not-too-distant future, public involvement in the foodgrain markets of Bangladesh will disappear, except perhaps for a role in mitigation of calamitous emergencies. Therefore, any short-term measures in the form of procurement or distribution should not make the path for long-term adjustment complicated and difficult. This implies that pricing grains in public procurement and open-market operations should bear some close consonance with market prices. Market price should be the guideline for these administered prices. Market price, on the other hand, appears to be much higher than export parity price, although import parity price is quite close to and occasionally a bit higher than market price.

Bangladesh's rice production has been increasing at a fast enough pace to result in a sort of surplus at market prices. This situation in domestic production might lead to a falling trend in domestic real prices of rice. Public pricing policies should guide this process of downward adjustment rather than attempt to prevent it. In the context of the recent suspension of the bulk of the rationing schemes, public procurement should also be slowed down. Otherwise, a large procurement would require a large-scale open-market operation in the absence of rationing channels. Large-scale procurement and open-market sales are likely to slow down the growth process in private-sector rice marketing. These considerations indicate that the present support price of rice should not be increased if for political reasons it cannot be lowered.

While the procurement price has obvious implications for the quantity of procurement, market prices, and the cost of the program, the operational efficiency of the program generally determines the cost-effectiveness and the degree of success in providing price support to farmers. The present practice of millgate procurement is found to be extremely ineffective, wasteful, and rampant with abuses. A transparent and competitive mode of procurement is called for to make the program effective and efficient. Procurement through an open-tender procedure is considered appropriate in this regard. Considerable internal resistance to this proposed change in the mode of procurement is not unlikely. Rice millers who benefit from current practices may act as a group to frustrate the change. However, it is the will of the government that ultimately matters in this type of reform.

APPENDIX 1: ESTIMATION OF PRODUCTION COST OF RICE, 1991/92

The method used to determine the full value of inputs to rice cultivation in Bangladesh is outlined in this appendix. All production stages (from plowing through threshing) are included. First, a few words about various cost concepts are in order.

COST CONCEPTS

At least four cost classifications seem plausible. Cost A₁ embraces all paid-out costs or expenses incurred in cash and kind on material inputs, labor, bullocks, and machine service. In particular, this includes payments for hired human labor and bullock power services; hired machinery charges; the imputed value of owned bullock and machine power; value of seeds, fertilizers, and pesticides (owned or purchased); manures (owned and purchased); irrigation charges; interest on working capital (excluding crop loan); interest paid on crop loans; and depreciation on farm implements and machinery; and so on. Cost A₂ equals cost A₁ plus the imputed value of family labor using market wage rates. Cost B equals cost A₂ plus rent paid for leased-in land plus interest on owned fixed capital, excluding land. Cost C includes cost B plus the rental value of owned land.

ADMISSIBILITY OF RENT AS A COST

The real choice is between cost B and cost C. In economic theory, accommodating the cost of a specialized resource, land for example, in an administered price is unsatisfactory. This is because such costs depend on the product price. When the latter increases, the costs of such resources increase, too, thus warranting fresh administered price increases. The inclusion of rent is similarly criticized. Hence it is questionable whether rentals on owned land ought to be included in costs. Finally, it has been argued that use of land for cultivation does not involve any cost to its owner in Bangladesh. The argument here is that the unit price of single-cropped, unirrigated land in Bangladesh rose by 17 percent annually during 1973-87, as against a 12 percent per year inflation rate during the period and a 13 percent interest rate on commercial bank deposits (Hossain et al. 1990, 33). Even when land is left fallow, investment in land pays more than other uses of money.

Public pricing discourse in this region, however, almost uniformly

includes rent on owned land as a cost (Sarma 1988).³ In Bangladesh, too, rent is included. Land rent was included in the present study after adapting estimates taken from Hossain et al. 1990.

All in all, the method corresponds to full valuation roughly on a cost C basis, plus a 50 percent margin to account for profit, risk margin, and all other own-account inputs. A sample estimate of full-valuation cost per maund for 1989/90 was revised to reflect 1991/92 prospective input prices on a rough basis. All data relate to the cost of aman paddy.

A few observations bearing on the character of the government's production cost data may be in order. Government data include a large provision for land rental. Calculations for 1989/90 boro costs put land rent at 21.4 percent of the average cost estimate. This seems to some people to be on the high side. Second, interest is charged on all paid-out expenses, including irrigation. However, this would overstate costs for those farmers who pay for water in kind, after the produce is harvested. Third, while government data in costs per acre are probably comparable to IFPRI estimates and Bangladesh Institute of Development (BIDS) estimates (after adjustment for inflation), the government's yield figures are countrywide averages, which are lower than averages from sample surveys. These countrywide estimates of costs per unit of output are bound to be lower than IFPRI's (or anybody else's) sample estimates. The numerator and denominator both have to be measured consistently.

It is pertinent that the major results (for the aman season) between the Hossain et al. (1990) study for 1987/88 and the IFPRI farm survey for 1989/90 are sufficiently similar after an adjustment for inflation is made (Tables 5 and 6). Yield rates, labor use per land unit, cost per unit of output, and the share of HYVs in aman area are fairly similar between these two studies. The Hossain et al. study was jointly done by BIDS/IRRI, using surveys of 1,245 households from 62 randomly selected villages. The IFPRI farm survey sample had 620 households from 34 villages throughout Bangladesh.

Table 7 contains comparative estimates of the cost of boro paddy per maund from three sources, namely Hossain et al. (1990), the IFPRI farm survey, and the government of Bangladesh.

The major similarities between the Hossain et al. study (BIDS/IRRI) and the IFPRI farm survey are worth pointing out. First, the labor use per acre is very close, thus resulting in closely similar labor costs. (The other cost components in the Hossain et al. study are not separable.) Overall, costs per acre, excluding costs of land, are quite close,

³ The most usual definition of rent equates it with what the factor earns above the minimum level necessary for the factor to be retained in present use. The minimum may be depressed far lower than the cost of subsistence. Land is not an end in itself. At the minimum, it is meant to generate the means for subsistence. When the sum of returns to farm-supplied input and farm-operator surplus falls below the minimum subsistence of laborers on farms—which can sometimes be the case—the use of rent on owned land in cultivation to make up the difference does not seem to totally negate efficiency considerations.

Table 5—Estimated production costs of traditional and modern varieties of aman paddy, 1987/88 and 1989/90

Variety	Cost per maund ^a	
	1987/88 ^b	1989/90 ^c
	(taka)	
Local traditional aman paddy	86	97
Modern-variety aman paddy	99	112
All aman paddy sample average	90	102

Sources: BIDS/IRRI estimates (1987/88) are from M. Hossain, M. A. Quasem, M. M. Akash, and M. A. Jabbur, "Differential Impact of High-Yielding Varieties in Bangladesh" (Bangladesh Institute of Development Studies, Dhaka, 1990, mimeographed); IFPRI estimates (1989/90) are based on IFPRI Farm Survey.

^a Figures do not include cost of land and profit margin.

^b Full valuation at market prices, but no provision is made for putative interest on farmer investment in "working capital"

^c Full valuation at market prices, including accrued or imputed interests due to "working capital," which is equated with cost of purchased inputs plus imputed value of own-account inputs (for example, seeds) that are highly liquid. The estimate of total cost per maund of aman paddy (Tk 194 per maund) noted in the main text uses this and other relevant information. The assumption regarding profit margin and so on is the same as in Table 6.

Table 6—Production costs of boro paddy, 1989/90 and 1991/92

Item	1989/90	1991/92
	(taka)	
(a) Purchased input cost per acre, 1989/90 ^a	4,679	5,846
(b) Interest payments on working capital, 1989/90	108	135
(c) Cost per acre	4,787	5,981
(d) Yield rate/acre (in maunds)	(55.8)	(55.8)
(e) Cost per maund	85.8	107.2
(f) Land rent per maund ^b	13.0	15.0
(g) Cost per maund [(e) + (f)]	98.8	122.2
(h) Cost per maund, rent including profit and risk margin [(g) x 1.5] ^c	148.4	183.0
(i) Cost of family labor and other own-account inputs per maund	21.0	23.0
(j) Total cost per maund	169.2	206.0

(continued)

Table 6—Continued

Source: Computed from Table 7.

^a Purchased input cost per acre during 1987/88 was Tk 4,198 according to M. Hossain, M. A. Quasem, M. M. Akash, and M. A. Jabbar, "Differential Impact of High-Yielding Varieties in Bangladesh" (Bangladesh Institute of Development Studies, Dhaka, 1990, mimeographed). Allowing for inflation between 1987/88 and 1989/90, the two estimates are close. Between 1989/90 and 1991/92, the cost of purchased inputs as well as the interest payable on working capital is estimated to increase by 25 percent.

^b For most economists, inclusion of rent as a cost appears to have little or no "economic" justification. It is arguable, however, that pricing on efficiency terms cannot totally brush aside the following point relating to the need for labor to reproduce itself. When the sum of the cost of farm-supplied inputs and farm-operator surplus is lower than the cost of subsistence of "laborers" on the farm, the accommodation of rent as a "return" to owned land in cultivation to bridge the difference would seem to be consistent with efficiency.

^c A 50 percent margin for profit, risk premium, and so on, is applied to the average cost of purchased input plus rent. This procedure assumes that the gross margin in the farmer's mind will be related to his market purchases. Were the profit margin to be applied to full average costs, including family labor, this would amount to allowing family labor to earn market wages as well as profit—a highly questionable assumption in labor-surplus Bangladesh.

Table 7—Comparative cost structure for boro paddy from BIDS/IRRI, IFPRI, and government estimates

Item	1987/88 BIDS/IRRI Estimate	1989/90 IFPRI Estimate	1989/90 Ministry of Agriculture Estimate	1990/91 Ministry of Agriculture Estimate ^a
	(taka/acre)			
Human labor	2,734 (82.2) ^b	2,830 (81.8) ^b	3,148 (89.9) ^b	3,463 ...
Bullock power	...	417	561	589
Seeds/seedlings	...	310	554	606
Manure	...	83	155	155
Fertilizer	...	726	751	826
Pesticide	...	145	213	213
Interest on working capital	...	108	213	234
Cost per acre ^c	5,729	5,919	6,981	7,680 (10 percent)
Yield rate (maunds per acre)	(55.4)	(55.8)	(43.9)	(42.0)
Total cost per maund (excluding rent)	103.4	106.07	159.0	183 (15 percent)
Rental on land per maund	13.0	13.00	42.9	42.9

Sources: BIDS/IRRI estimates are from M. Hossain, M. A. Quasem, M. M. Akash, and M. A. Jabbar, "Differential Impact of High-Yielding Varieties in Bangladesh" (Bangladesh Institute of Development Studies, Dhaka, 1990, mimeographed); IFPRI estimates are based on IFPRI Farm Survey; Ministry of Agriculture estimates were obtained from the government of Bangladesh.
(Continued)

Table 7—Continued

^a Figures in parentheses in this column indicate percentage increase over the previous year.

^b This figure is the estimated labor coefficient per acre (in man-days).

^c Subtotals do not include cost of irrigation. Disaggregation was not possible with data from Hossain et al 1990. However, the close similarity between the returned costs estimated by Hossain and IFPRI is remarkable inasmuch as fertilizer prices fell by 7 percent in nominal terms between 1987/88 and 1989/90.

namely Tk 5,729 per acre and Tk 5,919 per acre. Note that, according to the International Fertilizer and Development Center's fertilizer market survey, the retail price of fertilizer in 1989/90 had fallen from that for 1987/88. Also, the price of diesel fuel dropped in 1989/90. Finally, yield rates are very close. Because both Hossain's and IFPRI's samples involved stratified random sampling techniques, the similarity of results induces some strong confidence in IFPRI's own position regarding cost estimates.

The IFPRI and Bangladesh government estimates for 1989/90 fertilizer and irrigation costs are very similar. However, all other government estimates are higher. This is sometimes due to questionable methodology. For instance, interest is charged on all cash investments in government costs. However, as already argued, this will overstate unit costs. The reason the government estimate of average cost is higher than that of either Hossain et al. or IFPRI has little to do with the differences in these line items. Rather, it has to do with a lower yield rate used in government calculations. In addition, accommodation of a large land rent leads to a high government estimate of average cost.

All in all, the large differences in average cost estimates are in spite of close similarities in costs per acre. The key issue is the yield rate in use. The government uses a lower yield rate based on countrywide crop-cutting estimates that have frequently been called into question.

COMPARATIVE AMAN AND BORO AVERAGE COSTS

Both BIDS/IRRI and IFPRI studies show that in 1987/88 and 1989/90 the average cost (including land) was lower for modern-variety paddy overall than for traditional varieties. On a given amount of land, adoption of modern varieties is often the avenue to increased output. The cost conditions of the farmers who adopted modern varieties therefore provide the point of reference. It turns out that the average cost (excluding land cost) for HYV boro is somewhat higher than for HYV aman. Hence the higher of the HYV average cost estimates is adopted here as the basis for procurement price. HYV boro has been and will remain for some time the major source of growth of rice output in Bangladesh. Consequently, two separate estimates for rice procurement price are given (that is, cost per maund), one for HYV aman, the other for HYV boro (see Table 1).

APPENDIX 2: DETERMINATION OF PROCUREMENT PRICE ON THE BASIS OF WORLD PRICE OF RICE

The procedures for deriving the world price equivalent of the domestic procurement price are as follows:

1. Decide on the particular grade of grain in the world market that is comparable with the most dominant grade in the domestic market for which the procurement program is relevant. In the case of the domestic market, the coarse variety is generally the grade that is procured by the government and consumed by the vast majority of the population. Finding an equivalent grade in the world market is a complicated task. Only two grades from the Thai market are shown in Table 8. There are about eight major grades in this market, but each major grade is again subdivided into about seven to eight subgrades, depending on the grain composition (that is, the extent as well as the dimensions of broken grain). The specifications for grades are very rigid in the world market but this is not the case in the domestic market. Bangladesh consumers are known to prefer domestic rice, even of relatively low quality, to imported rice. On the other hand, if domestic rice is marketed to other countries, they

Table 8—Rice prices in the Thai market, 1982-90

Year	15% Broken White Rice		A-1 Special White Rice	
	Posted Price	Actual Price	Posted Price	Actual Price
	(US\$/metric ton)			
1982	270	...	193	...
1983	259	...	191	...
1984	243	...	208	...
1985	210	...	169	...
1986	199	181	123	104
1987	216	203	160	149
1988	282	266	230	219
1989	310	282	235	215
1990	298	259	181	166

Source: U.S. Department of Agriculture, Foreign Agricultural Service, World Grain Situation, 1991.

generally prefer low-quality Thai rice to Bangladeshi rice. Thus, consumers' taste in Bangladesh differs from the taste of foreign consumers. This makes the task of selecting comparable grades quite difficult. For the purpose of the present exercise, the Thai 15 percent broken white rice is used as the relevant grade for assessing price on an import parity basis. This grade is usually the one that compares with domestic grades and consumers' taste.

The question has been raised as to why the Thai rice market price is used as a basis of calculation rather than rice exported by India or Pakistan. Thailand sells, in relatively large quantities and throughout the year, a number of homogeneously graded rice varieties. A few of these are comparable to Bangladeshi rice, at widely quoted prices. Thailand thus quite closely approximates an international market of rice grades of interest to pricing policymakers in Bangladesh. In contrast, the varieties exported by India and Pakistan are very specialized high-quality grades and are traded in smaller quantities. Neither Bangladeshi rice nor the bulk of Thai rice presently compares with these varieties.

The grade known as A-1 special in the Thai market is used here to examine the price on the basis of export parity. The price for this grade is slightly higher than the price Vietnam is getting for export in the world market. For example, the actual price of A-1 special in the Thai market was about US\$180 per metric ton while Vietnam was selling it at about US\$165 per ton in 1989/90. It is understood that the World Bank recently asked some rice-trade consultants in Bangladesh to examine the price that the Bangladeshi coarse rice could fetch in the world market. These consultants provided the opinion that rice grown in Bangladesh would probably receive about US\$160 per ton in the world market.

2. It is well known that world price is more volatile than domestic price. For this reason, the trend of world price rather than the actual price is considered relevant for the purpose of keeping domestic price in line with the world price. For the present exercise, a three-year moving average is used as the guide for picking a world price.

3. The official exchange rate (Tk 36.00 equals US\$1.00) is used in converting dollar prices into taka prices.

4. The import parity (MP) price at producer level is calculated as follows:

$$\begin{aligned} \text{MP} &= \text{BPH} (1 - b_2), \text{ and} \\ \text{BPH} &= (\text{CIFP} \cdot e) (1 + b_1), \end{aligned}$$

where

$$\begin{aligned} \text{BPH} &= \text{border price at wholesale level;} \\ \text{CIFP} &= \text{f.o.b. price plus shipping and insurance cost;} \\ b_1 &= \text{rate of marketing cost, including profit for business,} \\ &\quad \text{from port to wholesale (assumed 15 percent);} \end{aligned}$$

b_2 = rate of marketing cost between wholesale and farm level
(assumed 10 percent); and
 e = exchange rate.

Inserting the relevant values in the above formula yields the following estimate:

$$\begin{aligned} \text{BPH} &= [(297 + 20) \times 36] (1.15) \\ &= 13,124. \end{aligned}$$

Thus,

$$\begin{aligned} \text{MP} &= 13.124 (1 - 0.10) \\ &= \text{Tk } 11,812 \text{ per metric ton.} \end{aligned}$$

In terms of taka per maund, the import parity price at producer level is Tk 441 (11,812/26.8).

This estimate is in terms of annual average. To derive the floor price, providing a price band of 15 percent (7.5 percent above the average and 7.5 percent below it), the average price is multiplied by the fraction 0.925 (1 - 0.075) to get the floor price or procurement price of Tk 408.

5. The export parity (EP) price at producer level is calculated as follows:

$$\text{EP} = \text{WP} \cdot e - \text{MC},$$

where

$$\begin{aligned} \text{WP} &= \text{f.o.b. world price in dollars/metric ton,} \\ \text{MC} &= \text{marketing cost from farm to export point (assumed 22} \\ &\quad \text{percent of WP in takas, and} \\ \text{EP} &= 215 \times 36 - \text{MC} \\ &= 7,740 - 1,703 \\ &= \text{Tk } 6,037 \text{ per metric ton, or} \\ &\quad \text{Tk } 225 \text{ per maund of rice.} \end{aligned}$$

As was the case with the import parity price, the estimate of export parity price is in annual average price. To derive the floor price, the annual average is multiplied by a factor of 0.925. This estimate is equal to Tk 208 per maund.

6. The average of import and export parity floor price is $(408 + 208)/2 = 308$.

Thus, the world price criterion leads to a procurement price estimate for the 1991/92 rice crops of Tk 308 per maund. This compares with the current procurement price of Tk 358. In terms of paddy, using the current rice/paddy price ratio, the estimated procurement price is about Tk 205 per maund. This compares with the current procurement price of Tk 240 per maund of paddy.

7. In conclusion, a few observations are in order. First, the annual average world price conceals the considerable variation in world prices across seasons. Generally, prices in the months of November through February are about 8-10 percent lower than the average. Therefore, the timing of an import order can be quite important. Second, there is a 10-15 percent difference between the posted price (used in this calculation) and the actual price. Third, purchase in cash implies a lower price than purchase on credit through government-to-government contracts. Finally, the complex grading system in the world market warrants caution and checking in order to ensure that the grade on which the price was negotiated and paid is the grade of rice that is actually delivered at the home port. It is observed that, for the same recorded grade, the price at which the government of Bangladesh had purchased rice in the past was considerably higher than the posted price published in the *World Grain Situation and Outlook*. One of the reasons could be that the government generally bought rice from the world market in the months when prices were higher than the average.

APPENDIX 3: PREDICTING 1991/92 RICE PRICE USING AN AGGREGATE RICE SECTOR MODEL, BANGLADESH

This appendix contains the formulation and estimation of a four-equation model that permits predictions of rice wholesale prices in 1991/92.⁴

The model's structural form is as follows:

$$\begin{aligned} PR_t &= f_1 (Y_{t-1}, MSR_t, SW_t, OSR_t), \\ MSR_t &= QR_t - QRP_t + MRD_t, \\ QRP_t &= f_2 (QR_t, PR_t, ADPR_t, OSR_t), \text{ and} \\ MRD_t &= f_3 (PR_t, RPR_t, Z_t), \end{aligned}$$

where

- t = time index,
- PR_t = price of rice in real terms (nominal price deflated by manufactured goods price index),
- MSR_t = market supply of rice per capita,
- QRP_t = public rice procurement from domestic production per capita,
- MRD_t = per capita rice offtake from public rationing system,
- Y_t = per capita real income (disposable income deflated by national income deflator),
- QW_t = production of wheat per capita,
- OSR_t = opening government stock of rice per capita,
- QR_t = production of rice per capita,
- ADPR_t = rice procurement price in real terms,
- RPR_t = rice ration price in real terms, and
- Z_t = availability of rice from public stock per capita during year, which equals opening stock plus import plus public procurement.

It is possible to solve the above system of equations for the four unknowns, namely PR, MSR, QRP, and MRD. Because the number of endogenous

⁴ Ahmed and Bernard (1989) were the first expositors of this model. Shahabuddin modified it somewhat before using it for recommending a procurement price for 1989/90 (Shahabuddin 1990). The present model bears on Shahabuddin's work, with one important addition, on treatment of private stock changes. Given the availability of annual data needed, it is not immediately obvious how this aggregate model could be made a great deal better. Ahmed and Bernard (1989) showed earlier that a more fully specified model with 1960-64 data yielded poor results. Hence, such an effort is not repeated here.

variables on the right-hand side of any relation is less than that of the exogenous variables excluded from it, the parameters permit identification. The model was estimated using two-stage least squares (TSLS) and data for 1975/76 through 1989/90 (see Table 9). The reduced form can be seen in Table 10.

Table 9—Estimated equations for price prediction model

Equation and Variables	Estimated Coefficient	t-Value	R ²	D.W.
Price equation				
Constant	-28.559	-0.64	.83	2.34
Income (Y _{t-1})	0.090	4.94		
Market supply of rice (MSR _t)	-0.016	-0.05		
Wheat production (QW _t)	-0.555	-1.89*		
Opening stock of rice (OSR)	-1.081	-2.49**		
Procurement equation				
Constant	-22.627	-1.83*	.75	1.21
Production of rice (QR _t)	0.220	2.76**		
Market price of rice (PR _t)	-0.615	-2.84**		
Procurement price (ADPR _t)	0.489	1.48		
Opening stock of rice (OSR)	-0.134	-0.51		
Ration equation				
Constant	10.764	2.49**	.70	1.42
Market price of rice (PR _t)	0.009	0.06		
Ration price (RPR _t)	-0.254	-2.60**		
Availability of government stock (Z _t)	0.111	0.71		

* Significant at the 0.10 percent level.
 ** Significant at the 0.05 percent level.
 *** Significant at the 0.01 percent level.

Table 10—Reduced-form coefficients of rice price determination model, Bangladesh, 1976-90

Variable	C	Y(-1)	QW	OSR	QR	ADPR	RPR	Z
PR	-28.8069	0.0893	-0.0552	-1.0727	-0.0124	0.0078	0.0041	-0.0018
QRP	-4.8907	-0.0550	0.3388	0.5258	0.2282	0.4846	-0.0025	0.0011
MRD	10.4937	0.0008	-0.0052	-0.0101	-0.0000	0.0001	-0.2549	0.1111
MSR	15.3844	0.0558	-0.3439	-0.5359	0.7717	-0.4845	-0.2524	0.1100

(continued)

Table 10-Continued

Note:	C	=	constant,
	Y	=	income,
	QW	=	production of wheat per capita,
	OSR	=	opening government stock of rice per capita, QR=production of rice per capita,
	ADPR	=	rice procurement in real terms,
	RPR	=	rice ration price in real terms,
	Z	=	availability of rice from public stock per capita during year,
	PR	=	price of rice in real terms,
	QRP	=	public rice consumption from domestic production per capita,
	MRD	=	per capita rice offtake from public rationing system, and
	MSR	=	market supply of rice per capita.

The model treats OSR_t, Z_t, and rice imports as exogenous, the first two explicitly. (For justification, see Ahmed and Bernard 1989.) The inclusion of beginning-of-period public stocks is motivated by the assumption that they negatively affect private storers' price expectations in the future. More specifically, by future is meant the period during July through October—typically a lean period. Decreases in price expectations in the future are assumed to increase supply from storage, which is likely to lower market price. Hence, the price equation is posited to have a negative coefficient on the public-stock argument. The model is therefore not totally without any treatment of changes in private stocks. This is a desirable feature. By all accounts, the relative share of privately traded paddy/rice in the entire rice market is probably growing through the period under reference.⁵

Estimated equations are presented in Table 9. The estimate of the price equation is plausible. Derived income elasticity is 0.36. This is consistent with other estimates. The derived price elasticity (-0.07) is lower than other estimates. This specification is considered less vulnerable to the omitted-variable criticism: price elasticity would have been higher if opening public stocks were not in the equation. It is possible that gains in public stocks dampen market price. Increases in wheat production, too, depress rice prices, although the effect is not statistically significant.

PROCUREMENT EQUATION

Like its precursors, this model establishes the strong effect of both market and administered prices on rice procurement. Increases in market price lower public procurement, and increases in procurement price increase the quantity procured. Elasticity is significantly higher

⁵ Akhter Ahmed estimated, using an indirect method, gross marketed surplus for 1986/87 at 42 percent of net production (Ahmed 1990). For the 1989/90 aman season, the results from a farm stock survey directed by Muimuddin Chowdhury at IFPRI, Dhaka, suggest the ratio is 43 percent. For all of 1989/90, the ratio will be higher.

for the market price. This difference in the two price elasticities suggests the existence of transaction costs in the public procurement program that are unrelated to the "normal" handling margins of private trade. The significant positive impact of production on the quantity procured is reestablished.

THE RATION EQUATION

Both market and administered ration prices have correct signs. The latter is significant, too. Relative prices are again shown to have become influential in determining the public ration offtake in recent years. Availability of government stock has the correct sign albeit on a weak coefficient.

PREDICTIVE POWER OF THE MODEL

In historical simulations, the model performed well in tracking rice price, ration offtake, and market rice supply variables. Their inequality indexes computed for PR, MSR, QRP, and MRD are 3.70 percent, 5.3 percent, 24 percent, and 8 percent, respectively. Adequate predictive performance for PR, MSR, and MRD is promising. As with other models, prediction of rice procurement is relatively less accurate.

DETERMINATION OF RICE PROCUREMENT PRICE

The steps involved here are (1) making a prediction of market rice price in 1991/92, using this model and after generating a set of forecasts on the exogenous variables; (2) comparing predicted price with trend price; (3) choosing the annual target price (ATP) at the lower (higher) value of the target price band if the predicted price is lower (higher) than the trend price (the target price band used in this exercise is one allowing 8 percent variation in annual price due to production fluctuations); (4) fixing target wholesale "floor" and "ceiling" prices consistent with an established pattern of seasonality; (5) arriving at procurement price by netting farm-to-wholesale-level marketing margins from the target ceiling price.

Following Ahmed and Bernard (1989), a seasonal price band of 16 percentage points is used in this exercise. The predicted price in 1991/92 is lower than the normal price. The ensuing calculations for determining rice's procurement price are shown in Table 11. The resulting estimated rice procurement price is Tk 346 per maund. This is higher than the procurement price of Tk 338 during the 1990/91 aman season. (This was subsequently raised to Tk 358 per maund before the 1991 boro season.)

Table 11-Calculation of rice procurement price, 1991 aman crop

Item	Price
(a) Predicted nominal price, 1991/92	434
(b) Trend price, 1991/92 ^a	437
(c) Annual target price [(b) x 0.96]	419
(d) Target floor price, wholesale, [(c) x 0.92] ^b	396
(e) Target ceiling price, wholesale, [(c) x 1.08] ^b	452
(f) Farm-to-wholesale-level marketing margin (as percent of wholesale price in rice) ^c	10.2
(g) Rice procurement price, 1991/92	346
(h) Paddy procurement price, 1991/92 [(g) x 0.665]	230

Source: IFPRI Farm Survey.

^a A semilogarithmic quadratic trend is used on real price series.

^b A 16 percent band for seasonal price variation is used.

^c This figure is obtained from the IFPRI survey of the rice market in Bangladesh.

TRAINING STAFF ECONOMISTS TO USE THE METHODS

It may appear that the procedures developed are quite complex. To ensure that the staff economists of the Ministry of Food can use the procedures after the end of IFPRI's Food Policy Project, a series of training sessions were conducted with selected staff economists. A number of such persons, particularly one (Nasar Farid) were found to be skilled enough to adopt and use the procedures with the aid of computer software installed in Dhaka. The steps followed in the training course are outlined in Appendix 4.

APPENDIX 4: TRAINING IN THE ANALYSIS OF PROCUREMENT PRICES

Francesco Goletti and Nasar Farid

INTRODUCTION

The purpose of the training is to provide instruction in using Lotus and TSP software to conduct simple policy exercises with a specific procurement model. The training is divided into ten steps that can be presented in five two-hour sessions on consecutive days. The steps are briefly summarized below and are detailed in the "Procedure" section.

- STEP 1 Introduce the Ahmed-Chowdhury-Ahmed model of procurement. Set up the equations and explain the major variables.
- STEP 2 Consider three main tasks:
 - Organizing the data base needed to implement the model.
 - Getting a "feeling" for it, with the use of graphs.
 - Obtaining descriptive statistics.
- STEP 3 Explain the meaning of trend. Give an example. Explain the difference between a linear and a quadratic trend.
- STEP 4 Define the difference between the exogenous and the endogenous variables. Express the endogenous variables as a function of the exogenous variables.
- STEP 5 Compute trends of all exogenous variables.
- STEP 6 Estimate the model, using the two-stage least squares technique. Briefly discuss problems of simultaneity.
- STEP 7 Compute reduced form.
- STEP 8 Compute predicted values of exogenous variables, price trend, and price index for 1991/92.

To obtain a diskette containing the files for this exercise, write Francesco Goletti, International Food Policy Research Institute, 1200 17th Street, N.W., Washington, D.C. 20036, or IFPRI, No. 48 (new), Road No. 15 (new), Dhammond R/A, Dhaka 1209, Bangladesh.

STEP 9 Compute procurement price according to Ahmed-Chowdhury-Ahmed.

STEP 10 Compute export and import parity prices, and put together all the previous steps.

Lotus can be used to do step 2, step 7, step 9, and step 10. TSP will be used in the analytical part involved in step 3, step 5, step 6. Step 10 will also make use of word processing software; for example, WordPerfect.

PROCEDURE

STEP 1 Set up the model and define variables. The procurement model to be implemented is given by the following equations:

$$PR_t = f_1(Y_{t-1}, MSR_t, QW_t, OSR_t), \quad (1)$$

$$MSR_t = QR_t - QRP_t + MRD_t, \quad (2)$$

$$QRP_t = f_2(QR_t, PR_t, ADPR_t, OSR_t), \quad (3)$$

$$MRD_t = f_3(PR_t, RPR_t, Z_t), \text{ and} \quad (4)$$

$$Z_t = OSR_t + MR_t + QRP_t, \quad (5)$$

where

- PR_t = price of rice in real terms (nominal price deflated by manufactured goods price index);
- MSR_t = market supply of rice per capita;
- QRP_t = public rice procurement from domestic production per capita;
- MRD_t = per capita rice offtake from public rationing system;
- Y_t = per capita real income (disposable income deflated by national income deflator);
- QW_t = production of wheat per capita;
- QR_t = production of rice per capita;
- $ADPR_t$ = rice procurement price in real term;
- RPR_t = rice ration price in real terms;
- OSR_t = opening government stock of rice per capita;
- Z_t = available rice from public stock per capita during year, which equals opening stock plus import plus public procurement;
- MR_t = rice imports per capita; and
- t = time index.

STEP 2 Practice data base management.

Exercise 1 Retrieve data from worksheet TAB1TRA.WK1.

Exercise 2 Create variable in Table 2 from data in Table 1. (These are training tables, not included here.)

Exercise 3 Produce a graph, plotting market price PR, procurement price ADPR, and ration price RPR against time.

Exercise 4 Produce means and standard deviations for all variables to be used in the model.

STEP 3 Explain trend analysis. Trend analysis allows one to understand the behavior of a variable over time, summarizing its growth process in a succinct way. The most common way to measure the trend and growth of a variable that changes over time is to regress its logarithm over time.

x_t is a variable indexed by time t .

$$\log(x_t) = \alpha + \beta \cdot t + \epsilon_t. \quad (6)$$

Equation (6) allows estimation of a linear trend; the parameter β can be interpreted as growth rate, for most practical purposes. To study how the growth rate changes over time, a quadratic trend is estimated; this involves the estimation of the regression

$$\log(x_t) = \alpha + \beta \cdot t + \gamma \cdot t^2 + \epsilon_t. \quad (7)$$

Exercise 5 Compute the linear trend of rice production between 1972 and 1990. Use TSP to read the data contained in QR.PRN.

Exercise 6 Compute the linear trend of wheat production between 1972 and 1990.

Exercise 7 Compute the quadratic trend of rice and wheat production between 1972 and 1990.

Exercise 8 Identify the significative quadratic trend in the previous exercises and interpret it.

STEP 4 Explain the relationship between endogenous and exogenous variables. Endogenous variables are determined in the model as a function of exogenous variables. The model is

in fact a relation between endogenous variables, the ones that it tries to explain, and exogenous variables, the ones that act as explicative variables. In order to identify the parameters linking exogenous to endogenous variables, enough exogenous variables are needed.

Exercise 9 Suppose you are given the simple model of rice price determination that follows:

$$\text{demand: } D_r = f(P_r, Y, \text{rurpop}), \quad (8)$$

$$\text{supply: } S_r = g(P_r, \text{irrig}, \text{fertil}), \text{ and} \quad (9)$$

$$\text{equilibrium: } D_r = S_r, \quad (10)$$

where

D_r = demand for rice,

P_r = price of rice,

Y = income,

rurpop = rural population,

S_r = supply of rice,

irrig = share of irrigated acreage, and

fertil = fertilizer use.

Determine which variables are endogenous and which are exogenous:

Endogenous Variables: $P_{r,t}$, NSR_t , QRP_t , MRD_t , Z_t .

Exogenous Variables: Y_{t-1} , QW_t , QR_t , $ADPR_t$, OSR_t , RPR_t , MR .

STEP 5 Compute trend of exogenous variables.

Exercise 10 Compute the trend of all exogenous variables for the period 1981/90. Remember that the exogenous variables are $ADPR$, RPR , QR , QW , OSR , MR , Y_{t-1} . Use the file EXOGENO.PRN.

STEP 6 Estimate the model.

Exercise 11 Use data contained in file PROCUDAT.PRN to estimate the model by two-stage least squares.

Exercise 12 Try to understand the extent of simultaneity of endogenous variables in the system that you estimated in the previous exercise. Also try to understand how shocks to one equation

are transmitted to other equations, and hence the need to use *instrumental variables*.

STEP 7 Explain reduced form. Reduced form is necessary to express the endogenous variables as a function of the exogenous variables. Knowing the reduced form allows performance of policy exercises.

Endogenous variables = $f(\text{exogenous variables})$

To get the function f , first estimate the system given by equations (1) to (5); then invert the matrix linking the left-hand side and the right-hand side of the system.

Exercise 13 Put the system in *matrix* form: $y = Ay + Bx$.

Exercise 14 Substitute numbers into A and B .

Exercise 15 Compute the inverse of $(I-A)$, where I is the identity matrix. The inverse is used to derive the *reduced form* given by

$$(I - A)^{-1}B$$

The inverse of a matrix can be computed in Lotus. See file STRUCTUR.WK1.

STEP 8 Compute trends and prices.

Exercise 16 Use the computed trend estimates for exogenous variables to get the predicted value of exogenous variables for 1991/92.

Exercise 17 Use the file NOMINAL.PRN to compute the quadratic trend of nominal prices and the linear trend of the index of manufactured goods.

Exercise 18 Use the reduced form to get the predicted value of real prices for 1991/92.

STEP 9 Compute procurement prices.

Exercise 19 Compare the price trend with the predicted value, and apply the Ahmed-Chowdhury-Ahmed methodology to get procurement prices. See spreadsheet STRUCTUR.WK1.

STEP 10 Compute export and import parity prices.

Exercise 20 Use the file WORLD.WK1 to compute three-year moving averages of world prices.

To calculate *import parity*, follow the steps below:

1. Determine which grade of rice in international rice markets should be taken as a basis for comparisons with domestic prices? A-1 or 15 percent broken as quoted by the Thai board?
2. Take a trend of world prices, for example, a three-year moving average.
3. Use the appropriate exchange rate to convert U.S. dollars into taka.
4. The import parity (MP) price at the producer level is calculated as follows:

$$MP = BPH (1 - b_2), \quad (11)$$

and

$$BPH = (CIFP \cdot e)(1 + b_1), \quad (12)$$

where

BPH = border price at wholesale level;
CIFP = f.o.b. price plus shipping and insurance cost;
 b_1 = rate of marketing cost, including profit for business, from port to wholesale (assumed 15 percent); and
 b_2 = rate of marketing cost between wholesale and farm level (assumed 10 percent).

To derive a floor price, providing a band of 15 percent, this estimate of import parity is multiplied by $(1 - 0.075)$.

For *export parity* (EP), use the following calculations:

$$EP = WP \cdot e - MC, \quad (13)$$

where

EP = world price;
WP = f.o.b. world price in U.S. dollars per metric ton, and
MC = marketing cost from farm to export point (assumed 22 percent of WP in taka).

As in the case of export parity price, to derive the floor price, this annual average is multiplied by a factor of 0.925.

Since Bangladesh is neither an importer nor an exporter of rice, the reference international price for the procurement price is the average of these two floor prices.

$$\text{Reference price} = (\text{floor MP} + \text{floor EP}) / 2.$$

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