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THE POTATO MARKETING SYSTEM AND ITS CHANGES IN BANGLADESH: FROM THE PERSPECTIVE OF A VILLAGE STUDY IN COMILLA DISTRICT

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This paper analyzes the marketing system of potato in Bangladesh, especially the economic relations among farmers, traders, and cold storage owners and elucidates the structural changes in the rural economy through a village study. Investment in the potato market is capital-intensive and risky, and is often considered to be vertically linked. The present study shows that farmers and cold storage owners do not invest in trading because of lack of time and "skill" to deal with urban traders. Besides, farmers face capital constraints and the amount of potatoes produced is too small to meet the demand of urban areas. Cold storage owners are confronted with increasing competition, which forces them to attempt to reach the storage capacity. Traders invest in the risky potato-storage business. The return from it is declining but still high due to the "cheap" credit supply from the cold storage owners. There is no tied relation among the market agents any more.

I. INTRODUCTION

IN Bangladesh, as in India and in the other South Asian countries, the success of the Green Revolution in the rice sector since the late 1970s[1] has caused a continuous decline in the real rice price[2] and a lower return from production, inducing farmers to increase the cultivation of non-rice crops.[3] Potato has been considered to be one of such promising crops, and especially after the introduction of cold storage facilities (hereafter, referred to as "cold storages"), it became

1 The success of the Green Revolution in Bangladesh can largely be attributed to the development of shallow tubewell irrigation. See, for example, Hossain (1988) and Palmer-Jones (1999).

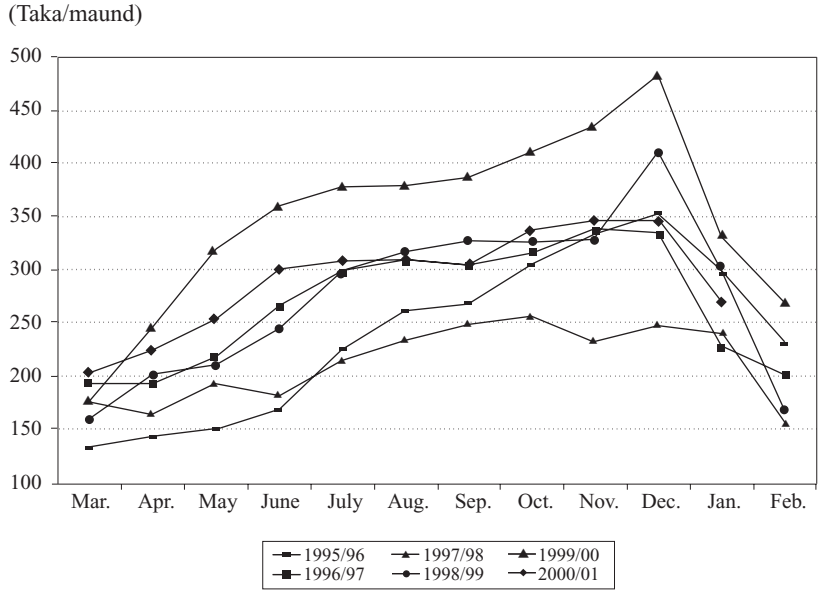
2 According to the estimates by Dorosh (2000), the real rice price in Bangladesh (1998 price) was about 15–20 taka per kilogram during the late 1970s, but it continuously declined to about 10–13 taka per kilogram in the late 1990s. The seasonal fluctuations of the rice price, an acute problem before, were also largely eliminated during the concerned period. See Chowdhury (1992) and Chowdhury and Haggblade (2000).

3 Based on a thorough analysis of profitability of crop production in Bangladesh, Mahmud, Rahman, and Zohir (2000) concluded that several crops, including potatoes, vegetables, onions, and cotton, show both economic and private returns that are high or higher than those of high-yielding variety (HYV) rice.

more popular as it can now be consumed almost over a whole year,[4] while most vegetables are available only seasonally due to the lack of preservation and/or processing facilities for such perishables. Low-income households consume cheap potatoes more than other vegetables (Pitt 1983; Poats 1986) and potato consumption in Bangladesh is next only to two major cereals, rice and wheat.[5] On the supply side, the availability of cold storages promoted the increase of production of potato and generated much larger value added than before in the storage and marketing process, because there is a high seasonal difference in price between the harvest season and the other seasons in "normal" years.

Figure 1 shows the seasonal fluctuations of the wholesale price of potato (national average) during the period from 1995/96 to 2000/2001. It reveals that in the major harvest season, March, the price ranged from 130 to 200 taka[6] per maund (one maund = approximately forty kilograms) while in the peak season, Novem-

Fig. 1. Seasonal Fluctuations of Potato Price (Urban Wholesale Market), 1995–2001



Source: BBS (various issues).

4 The average per capita daily consumption of potato increased from 39.5 grams in 1988/89 to 43.7 grams in 1991/92, and further to 49.5 grams in 1995/96 (BBS 1995, 1998).

5 According to the *Food Balance Sheet: 1992−94 Average* (FAO 1996), per capita annual supply of food items in Bangladesh were as follows; i.e., rice (175.3 kg), wheat (19.9 kg), potato (9.8 kg), sweet potato (3.5 kg), pulses (3.7 kg), beans (0.7 kg), vegetables (except for tomato and onion) (8.6 kg), etc.

6 U.S.$ 1= 53 taka at the time of the survey.

ber,[7] it reached 300 taka or more, leaving a large difference of as much as about 150 taka per maund. During this period the price usually increased steadily at a rate of about 10–15 per cent per month. It should be noted that in some years, the price may not rise as expected. In other words, since the investment in the potato market is associated with high risk and high return, the problem is to determine who is investing in this market and is obtaining profit, while bearing risk, and how.

Mahmud, Rahman, and Zohir (2000) pointed out that in spite of the high profitability of chilled potatoes (in cold storages) one of the factors, which retard their supply is the high price risk associated with the marketing of potatoes. In other words, they consider that the high profitability of supplying chilled potatoes is only compensated by the high price risk. And they further argued that imports (of potatoes) are desirable during lean seasons, taking into account the economic cost of storage and chilling.

On the other hand, from anthropological viewpoints Lewis (1991) who conducted an in-depth study on the potato market in a region in Bangladesh observed that interlinked transactions in the potato market among farmers, traders, and cold storage owners were widespread and he concluded that cold storage owners dominated the market by extending advanced money to traders and farmers.[8] Crow and Murshid (1994) also showed the existence of interlinked transactions between big traders and petty traders in rice marketing, pointing out the structure of exploitation of the latter by the former. As these studies indicate, agrarian market in Bangladesh has so far (at least during the 1980s) been often explained by the dominance of those with abundant capital resources (vertical integration) and the resulting inequitable distribution of benefit.[9]

However, as discussed in detail in this paper, with the gradual increase in the number of cold storages, the problem of declining profitability with underutilized capacity had already started to emerge in the late 1980s (Maziruddin 1989).[10] Thereafter, the number continuously increased, which resulted in a further de-

[7] November is the last month for sales of stored potatoes at a high price, although a major part is sold out by October. Thereafter the demand declines due to poor quality. The peak price in December observed in Figure 1 is related to the supply of new and fresh potatoes from northern regions with a rather limited amount.

[8] Concerning the general situation of potato production and marketing in the mid-1980s, see Scott (1988).

[9] See also Crow (1989).

[10] Cold storage was first introduced into Bangladesh in the early 1960s. As the production of potato increased rapidly (2.6 per cent in the 1980s and 3.6 per cent in the 1990s per year, respectively), the number of cold storages increased faster than the production (Rabbi 1998). In Comilla District too, the operation of cold storages was very limited in the 1960s and 1970s with the number of only three to four, but the use of cold storages was widely disseminated in the 1980s and 1990s and a total of thirty-two cold storages were in operation in the locality by the end of the 1990s. The sharp increase was attributable to the deregulation policy of the government to lift all the barriers for establishing cold storages.

cline of the profitability of chilled potatoes.[11] But it should be noted that still high price risks had remained in the market until recently. The problem is, therefore, to analyze in detail the present situation of the potato market, which is crucial for appropriate policy recommendations.

Against this background, the authors have recently conducted intensive fieldwork in a village and surrounding areas, selected from Comilla District, the same region that Lewis (1991) studied. The authors found there a potato market characterized by a lack of vertical integration by cold storage owners, which was quite different from what Lewis observed, and which will be presented in this article in detail.

The purpose of this paper is to investigate the structure of the potato market and its changes in Bangladesh, and more importantly through these investigations, the structural changes in the rural economy and economic relations among rural (and partly urban) people in a wider context in the country are elucidated. Emphasis is placed on the analysis of the credit relations among various agents in the potato market, namely, producers (farmers), traders, cold storage owners, and others.

The composition of this paper is as follows. Section II presents the basic features of the study village, mainly land distribution, farming, and employment structure, followed by Section III in which the production and marketing channels of potato are described, including various market agents and their roles. Section IV analyzes the distribution of economic benefit among farmers, traders, and cold storage owners in the study carried out in the year 2000/2001 and Section V tries to analyze the more general structure of the potato market, taking into consideration the experience gained during the last five to ten years. Finally Section VI summarizes the argument and provides some concluding remarks.

II. THE STUDY VILLAGE

Potato production in Bangladesh was less than 0.2 million tons in the mid-1950s, increased to 0.5 million tons by the mid-1960s, and exceeded 1 million tons at the beginning of the 1980s, then reached more than 1.5 million tons in recent years. The traditional major producing areas included northern Bangladesh such as Dinajpur, Rangpur, Bogra, Rajshahi, Pabna, and Mymensingh (larger districts), but rapid growth was observed in Dhaka (in particular Munshiganj) and Comilla from the mid-1960s and especially after the 1980s, with the rapid dissemination of high-yielding varieties (HYV) of potato, and with the introduction of cold storages in particular.

[11] In spite of the argument by Maziruddin (1989), the number of cold storages gradually increased in the 1990s. The possible reason is that even though the rate of profit was declining, it was still high enough to attract new investments.

A village named Ashora was selected for the study from Debidwar *thana* (lower administrative unit below district), Comilla District. Comilla District is the second largest potato-growing district (new)[12] (19 per cent of total in 1997) after Munshiganj (35 per cent) and the second largest number of cold storages is also located there.

The village is located at a relatively high elevation and is free from regular floods, unlike many Bangladesh villages. With sandy or sandy loam soil and 100 per cent of groundwater irrigation available, agricultural land is highly intensively utilized; i.e., the typical cropping pattern is *aus* rice–*aman* rice–potato–*boro* rice,[13] namely, four cropping in a year. Mechanized tillage using tractors has been completely disseminated along with modern varieties of seeds and a large quantity of chemical fertilizers. The population density is very high (approximately 1,300 persons per square kilometer) and land distribution is highly skewed among households, with a relatively large number of landless people.

However, the study village has a good infrastructure. The Dhaka–Chittagong highway passes on the western side of the village and two big bazaars (Chandina and Nimsar) are located within a two-to-four-kilometer radius. The headquarters of the neighboring *thana*, Chandina, are located only two kilometers away, with all the other public amenities including banks, post offices, telecommunications, etc. Three cold storages for potato are located within a range of five kilometers. The village is also well connected with neighboring villages by wide earthen roads.

At first basic household-level information was collected during June–July 2000 using a questionnaire, covering all the households (106) residing in two *para* (hamlet) in the village.[14]

Table I shows the distribution of farmland among the households surveyed as well as the major occupation of the household head. It was revealed that 25 per cent of the households were landless and 57 per cent of farmland was concentrated in the hands of fourteen (13 per cent) largest landowners, hence a highly inequitable distribution of land among the rural households. However, since the average farm size of the landowning households was only 0.87 acres and very small, households with only more than 1.50 acres were classified into large landowning households (households with 0, 0.01–0.49, and 0.50–1.49 acres were categorized into landless, small, and medium landowning households, respectively). It should be noted here that about 30 per cent of the land is transferred mainly from large and medium landowners to landless and small landowners through land mortgage or land lease arrangements, which contributes to a more equitable distribution of

12 The former sixty-four sub-divisions were upgraded to district (new) through the local administration reform in 1985, which can be distinguished in Bangladesh from the larger districts (old) numbering only twenty.

13 *Aus*, *aman*, and *boro* are paddies grown in three different seasons.

14 There are four *para* in the village, namely, east (*purba*), middle (*madhya*), west (*pashchim*), and south (*dakshin*) and we conducted a total enumeration of households in the first two *para*.

TABLE I

LAND DISTRIBUTION AND OCCUPATIONAL STRUCTURE OF SURVEYED HOUSEHOLDS

Landownership-wise Category of Households (Acres)	Total No. of Households	Total Land Owned (Acres)	Major Occupation of Household Head (No.)							
			Farming	Agricultural Labor	Factory Labor	Working Abroad	Services	Potato Trading	Other Trading Business	Others
0	27 (25)	0.0 (0)	5 (19)	2 (7)	9 (33)	7 (26)	0 (0)	0 (0)	2 (8)	2 (7)
0.01–0.49	40 (38)	8.5 (12)	12 (30)	2 (5)	4 (10)	5 (13)	9 (22)	1 (2)	5 (13)	2 (5)
0.50–1.49	25 (24)	21.5 (31)	14 (56)	1 (4)	0 (0)	1 (4)	3 (12)	4 (16)	2 (8)	0 (0)
1.50–	14 (13)	39.6 (57)	7 (50)	0 (0)	0 (0)	2 (14)	1 (7)	4 (29)	0 (0)	0 (0)
Total	106 (100)	68.6 (100)	38 (36)	5 (5)	13 (12)	15 (14)	13 (12)	9 (9)	9 (8)	4 (4)

Source: Prepared by the authors based on the baseline survey conducted in June–July 2000.

Notes: 1. Figures in parentheses indicate percentages.
2. Services (*chakkri*) refer to permanent salaried jobs, including both government and private sector.
3. Other trading businesses include trading of molasses, hosiery goods, clothes, etc. which are highly labor-intensive.
4. Others include rickshaw pullers and minibus drivers.

land in terms of operation. Land lease is widely observed even on a seasonal basis. Rice is grown completely for subsistence purpose regardless of the farm size. Although large landowners grow rice three times a year, they utilize rice for home consumption[15] and for meals for hired laborers,[16] leaving almost no marketable surplus. By contrast, potato is grown as an important cash crop by all categories of farmers.

As Table I indicates, there are many off-farm job opportunities for the villagers. The majority of the landless and small landowners get off-farm wage (or salaried in the case of "services") jobs in the locality to which they can commute or abroad. Particularly many unskilled laborers are working in a private jute-processing mill located in an adjacent village, consisting mainly of landless and small landowners. Agricultural wage laborers are scarce in the village and they come seasonally from northern Bangladesh, far away from Comilla District. Large and medium landowners, on the other hand, are engaged either in farming or in self-employed business, including the potato-trading business in particular. International migration has a rather long history in the village, contributing significantly to the local economy. Large and medium landowners were the pioneers to go for work to the Middle East countries since the early 1980s, but as the working conditions worsened, they started to shift to other countries such as Singapore and Malaysia, seeking better employment opportunities. On the other hand, landless and small landowning households have started recently to emigrate to the Middle East, especially since the mid-1990s.

III. POTATO MARKET: MARKETING CHANNEL AND MARKETING AGENTS

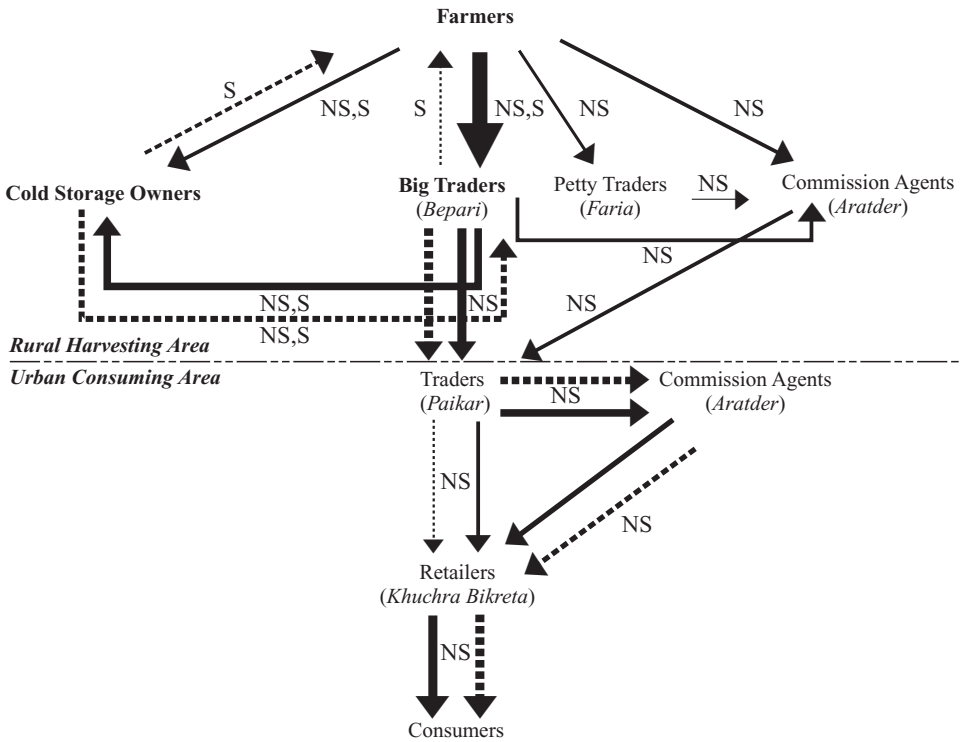
In general, the potato yield depends significantly on the quality of seed. The Bangladesh Agricultural Development Corporation (BADC) supplies certified seeds through appointed dealers, which ensures high yield, but the price is rather high. If BADC-certified seeds are multiplied, they can also be used as seeds, but only for one year, i.e., multiplication over two years causes a definite yield decline and is not economical. Some farmers produce seed potato in some parts of their farm plots for their own use in the next season and/or for sales, and others purchase seed potato every year either mostly from such farmers or sometimes from BADC.[17] Seed potato has to be stored in cold storages for use in the next year.

[15] Consumption of large farmers was higher due to the larger family size as well as the larger per capita consumption, through the addition of "*chira*" (a dry rice food processed through heating and pressing by machine) consumption in the morning for example.

[16] Employers have to serve meals to migrant laborers three times a day, while twice a day for local laborers.

[17] According to the Modern Industries (Bangladesh) and Agricultural Marketing Department (1998),

Fig. 2. Marketing Channels of Potato



Source: Parepared by the authors, 2000.
Notes: 1. NS and S denote non-seed and seed potato, respectively.
2. ⟶ indicates that potato is traded without storage in cold storage.
3. ⇢ indicates that potato is traded after storage in cold storage.
4. Thickness of arrow indicates approximate transaction through different sources.

The price of BADC-certified seeds per maund was 500–750 taka, while that of the farmers' multiplied seeds was 350–400 taka at the time of the survey.

Marketing channel of potato is illustrated in Figure 2. Now if we considered only non-seed potato, after the harvest of potatoes during March, there are several options for the farmers; (1) to sell them to traders (locally called *bepari*) immediately, (2) to sell them to traders after drying for two weeks, (3) to sell them to traders after storage at home for 2–3 months, and (4) to store them in cold storages and sell them in the market several months later. The advantage of (2) over

the BADC-supplied seeds met only 5–7 per cent of the demand for seed and farmers usually depend on the multiplied seeds sold by other farmers.

(1) is that by drying during a sufficient time, the skin of potato becomes thick and suitable for long-term storage in cold storages. Farmers sometimes choose (3) for expecting higher market price without utilizing cold storages but 2–3 months is the physical limit for such a storage at home.

The majority of the farmers, especially large and medium landowners, sell harvested potatoes in their homestead and receive cash from traders immediately or only some part of it is paid later, but within a week. Landless tenants and small landowners with less than 0.50 acres, on the other hand, sometimes sell their small amount to traders who are waiting in the nearby marketplace (Chandina or Nimsar[18]), in order to obtain a slightly higher price[19] and receive full payment on the spot. When collecting potatoes at farmers' homestead, traders themselves negotiate with the farmers, but thereafter, the actual operations are usually conducted by their hired laymen. There are no petty traders (locally called *faria*) between farmers and big traders (*bepari*). Most of such traders are the residents of the study village or the adjacent villages.

In the harvest season, traders work for more than twelve hours a day moving around wider areas, hiring a few laymen for weighing, packing, and transporting for maximum collection of potatoes within a short period of time. Although the harvest season is rather short, traders usually become specialized in their job on a full-time basis since they store part of the collected potatoes in cold storages and sell them later gradually over a whole year, while the other part of potatoes is sent immediately to urban areas for sale. The major destination of potato is Chittagong City but several numbers of small towns along the Comilla–Chittagong highway are also included as destinations. Traders in rural areas (*bepari*) usually get order to supply potatoes through a telephone call from urban traders (*paikar*) mainly in Chittagong, hire a truck for loading potatoes, and send it in order to reach the destination by the next morning. Urban and rural traders bargain only the price and they trust each other about the quality, time of arrival, time of payment, etc. Traders must have made tremendous efforts and spent a long time to establish such relations and to continue to maintain such relations. It seems that for the farmers it may be very difficult to establish such relations with urban traders.

Traders in rural areas store a part of purchased potatoes in the cold storages in the locality. Farmers usually do not store potatoes in cold storages by themselves, although some store not only seed potato but also non-seed potato for seeking extra profit.

18 Chandina bazaar is bigger than Nimsar bazaar and it is a regular marketplace with twice a week a periodical market (*hat*). Nimsar, on the other hand, is also a regular marketplace but it deals with vegetables only.

19 However, when selling at the marketplaces, the farmers have to bear the additional cost of market charge. The market is managed by the local municipality and the rate of market charge is decided by the leasee who obtained the right to collect it through bidding. Note that there is no market charge in Nimsar bazaar due to its small size.

In Chandina bazaar, several commission agents (*aratder*) deal with potatoes and they have their own permanent shops. They are basically brokers between traders (sellers and buyers), but they fulfill other multiple functions including potato trading at their own risk. When they collect potatoes from farmers in the harvest season, they generally use petty traders, not laymen. The major reason why they do not hire laymen is that they are too busy to go around for negotiations with farmers and they prefer to extend credit to petty traders and let them collect potatoes, transferring the major risk to them.[20] The commission agents are also residents of the nearby villages.

The urban people and not the rural residents, on the other hand, establish cold storages and appoint managers for their everyday operation and management. A cold storage owner interviewed spent more than 30 million taka for the establishment of the facilities in 1982, with a capacity of 60,000 bags of potatoes (equivalent to 120,000 maunds). The major task of the managers is to keep stored potatoes under the best conditions by maintaining a low and stable temperature (2˚C–4˚C) and by shuffling stored potatoes two or three times in a season to achieve sufficient aeration inside the bags evenly, to cope with the unfavorable power supply conditions in rural areas. Bad reputation of a cold storage due to damage caused by stored potatoes, once established, will harm the owner, especially under the fierce competition among the cold storage owners. The rate of storage charge is fixed to 80 taka per maund, regardless of the duration of the period of storage. They accept potatoes from a minimum of 10 maunds unit and for more than 200 maunds they lend an amount of 20,000–30,000 taka to the clients, but in this case 5 taka per maund are added to the storage charge. When clients who obtained a loan want to withdraw the potatoes from the storage they have to repay the debt in addition to paying 85 taka per maund for the storage charge. Cold storage owners do not sell the stored potatoes without traders' permission. As Lewis (1991) reported, in the past cold storage owners were also engaged in trading and even in "contract farming" with farmers, but now they tend to concentrate on their storage business only.

In such a situation it can be concluded that the traders residing in rural areas (and sometimes farmers) are the major players who invest in the potato market while taking risk, although in a sense cold storage owners also take some risk because when the potato price becomes too low, traders abandon the stored potatoes without (re)paying the storage charge and loan. Most of the traders are at the same time large farmers and they usually invest in farm machinery such as shallow tubewells and tractors, by which they can become engaged in a rental business

[20] The widespread existence of petty traders (*faria*) in rice marketing is in sharp contrast with the situation of potato marketing (Crow 1989). It can be hypothesized that the high seasonality of potato marketing due to its characteristics of commodity (namely, its perishable nature) basically accounts for such a difference.

also.[21] The other young members of the traders' households usually get some off-farm jobs, especially they work abroad and send remittances regularly.

However, investment in the potato market with risk is not totally shouldered by the traders (some farmers) and cold storage owners. When the traders store potatoes, the cold storage owners issue a receipt, which can be sold to someone else, thus transferring the ownership of the stored potatoes. In addition, mainly through commission agents in the wholesale market, anyone can purchase and store potatoes in the cold storages and obtain a receipt, which can be resold. Price of receipts fluctuates depending on various factors such as the demand for potatoes and other vegetables in urban areas, the production of potatoes in other areas, and the supply of other vegetables in the locality. But due to the low market price in the study year, traders purchased only a small number of receipts (the price was about 240–310 taka per maund during April–July). The majority of those who purchase and sell such receipts are non-traders locally called "stockiests," and most of them are urban or rural people with a stable salaried job ("service"). Profit and risk can partly be transferred through such a kind of stock market, although the influence of the "stockiests" is not very large and limited to only about 5 per cent of total supply, according to an interview with cold storage manager.

IV. DISTRIBUTION OF BENEFIT

Investment in the potato market is characterized by high risk and high return, as already indicated, and the analysis of such a market requires several years' data. Before proceeding, here we will analyze the market based on the data extensively collected for the year 2000/2001, through which some interesting results can be obtained by using observations from just one year. For that purpose an in-depth survey was conducted during August–September 2000, selecting fifteen potato farmers by using the stratified sampling method, and nine potato traders and three cold storage owners from the sample households and complementarily from the neighboring areas.

Let us first examine the characteristics of the price movement in 2000/2001. Figure 1 shows that in the study year, the potato price was relatively high in the harvest season (200 taka per maund), but after rising smoothly to 300 taka in June it stagnated and did not exceed 340 taka even at the peak in November. Therefore, although the price differential during March–November was not very low (146 taka), the price hike after June was disappointing especially compared to the last 1999/2000 year.[22] Actually the demand for potato from traders was high in the

[21] It was found that some of the traders, mostly aged 50 and above, previously worked as government-appointed dealers such as fertilizer dealers and ration shop dealers when such markets were regulated.

[22] In 1999/2000 the potato price increased continuously throughout the year because of the following

harvest season due to their expectation of higher future price. However, abundant supply of potatoes from northern Bangladesh later on[23] and a better supply of other vegetables such as brinjal, radish, and pumpkin at a lower price due to the good weather conditions in the year reduced the demand for potato already stored in the cold storages. Finally it is revealed that the traders and the "stockiests" who invested a large amount of money in the potato market failed to obtain an expected profit in the year 2000/2001. However, the movement of the potato price in 2000/2001 did not show a special unusual trend, as explained later in Section V.

Against this background, the distribution of benefit among farmers, traders, and cold storage owners will be analyzed for the year 2000/2001, based on the data collected in the study village.

A. *Farmers*

The sampled fifteen farmers (none of them were engaged in potato trading) in total produced 1,276 maunds of non-seed potato and 262 maunds of seed potato. Only seven farmers produced seed potato besides non-seed potato. In order to assess the farmers' benefit, the cost of production of potato was estimated separately for seed potato and non-seed potato (Table II). It was revealed that the yield of seed potato was 17 per cent higher than that of non-seed potato but that the production cost per acre was higher, resulting in almost the same production cost per maund of produce.[24] As will be shown later in Table IV, farmers also received almost the same market price for both kinds of potatoes in the harvest season.

It is evident from Table II that the cost of current inputs such as seed, fertilizer, irrigation, and tractor tillage is high, accounting for approximately two-thirds of the total cost. On the other hand, the cost of labor and land rental[25] is moderate and as a result the total average cost (including family labor) was estimated to be 130–40 taka per maund. Potato production is intensive in purchased inputs and farmers need a large amount of working capital, which can account for the higher share of large landowners engaged in potato production than in rice production.[26]

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factors: (1) the scarcity in the supply of potato from northern Bangladesh and (2) the low level of production of other vegetables due to the prolonged rainy season.

23 Supply of HYV-potatoes from northern Bangladesh such as Rangpur which showed an apparent increasing trend and occurred 1–2 months after the harvest in Comilla region, was mainly blamed for the stagnation of the potato price after June in 2000/2001.

24 The average yield obtained by the sample farmers for non-seed potato was 144 maund per acre, which is slightly higher than Comilla District (greater district) average of 136 maund per acre, as well as the national average of 141 maund per acre in 1997/98 (BBS 2000).

25 The land rent for 6 decimal (= 1 gonda, 100 decimal being equivalent to one acre), of land was 800 taka and 200 taka for one-year period and for one season, respectively. In both cases, tenants have to pay the rent at the time of the contract; i.e., before planting. By contrast, share tenancy was rare in the potato season, although it was relatively significant in rice cultivation.

26 Smaller landowners tend to have larger areas cultivated with rice, compared to potato, through the land lease market. In the *aman* rice season, landless tenants and small farmers cultivated 11

TABLE II

COST OF POTATO PRODUCTION

	Non-seed Potato	Seed Potato
Number of samples	*N* = 15	*N* = 7
Cost (taka/maund):		
(1) Current input costs	89 (64%)	87 (67%)
Seed	36	40
Fertilizers	33	30
Chemicals	7	6
Irrigation	6	5
Land preparation (tractor-use)	7	6
(2) Labor costs	25 (18%)	24 (18%)
Ploughing	1	1
Planting	7	6
Soil preparation	6	5
Fertilizer application & spraying	3	2
Harvesting	8	10
(3) Land rent	25 (18%)	20 (15%)
Total costs	139 (100%)	131 (100%)
Average owned land (acres)	1.29	1.63
Average cropped area of potato (acres)	0.65	0.22
Yield (maund/acre)	144	168

Source: Prepared by the authors based on the sample survey of farmers conducted in August–September 2000.

Notes: 1. In rural areas, one maund is equivalent to forty kilograms.
2. U.S.$1 = 53 taka at the time of the survey.

If we classify the cases according to the time of sale, 43 per cent of non-seed potato was sold immediately after harvest (A1), 38 per cent after two weeks' drying (A2), 4 per cent after storage for 2–3 months at home (A3), and the remaining 15 per cent after storing in cold storages (A4). In the case of seed potato, on the other hand, 5 per cent was sold to traders (B1) and the remaining 95 per cent was stored in the cold storage by farmers (B2). Table III shows how every farmer sold non-seed potato and seed potato, by classifying them into A1–A4 and B1–B2 channels, respectively. Out of 15 farmers who produced non-seed potato, 8 farmers did not use cold storages; out of them 3 farmers sold through A1 channel only, while 2 farmers through A1 and A2 channels and 1 farmer used A1, A2, and A3 channels. And another farmer sold through A2 channel only. The remaining 7 farmers utilized cold storages for a part of their produce. The percentage of cold-storage-stored potatoes by them was in the rage of 7–40 per cent with an (weighted) average of 27 per cent.

per cent and 24 per cent of total cultivated land, while in the potato season the proportions were only 7 per cent and 17 per cent, respectively.

TABLE III

SALES OF POTATO BY SAMPLED FARMERS IN 2000/2001

Sample Farmers' Serial Number	Owned Land (Acres)	Cropped Area of Potato (Acres)		Sales of Potato (Maunds)								Total Amount of Credit Borrowed (Taka)
		Non-seed Potato	Seed Potato	Non-seed Potato					Seed Potato			
				A1	A2	A3	A4	Total	B1	B2	Total	
1	0	0.27	0	4	4	6	0	14	0	0	0	7,000
2	0	0.51	0	6	53	0	12	71	0	0	0	5,000
3	0	0.60	0	1	76	0	6	83	0	0	0	7,500
4	0	0.23	0.07	20	0	0	10	30	0	10	10	7,000
5	0.05	0.51	0.15	6	34	0	10	50	0	16	16	6,000
6	0.06	0.30	0	0	35	0	0	35	0	0	0	59,770
7	0.45	0.35	0.04	8	36	0	0	44	0	6	6	5,500
8	0.45	0.30	0	15	20	0	0	35	0	0	0	0
9	0.72	0.24	0	50	0	0	0	50	0	0	0	21,000
10	0.72	0.03	0.30	0	4	0	0	4	14	6	20	12,300
11	0.90	0.48	0.12	12	46	30	20	108	0	30	30	12,000
12	1.08	0.75	0	34	25	16	34	109	0	0	0	11,000
13	1.20	0.83	0.18	57	0	0	0	57	0	40	40	1,600
14	2.14	1.86	0	0	150	0	100	250	0	0	0	0
15	8.14	2.48	0.70	336	0	0	0	336	0	140	140	700,000
Total				549	483	52	192	1,276	14	248	262	855,670
Proportion of sales in different seasons (%)				43	38	4	15	100	5	95	100	

Source: Prepared by the authors based on the sample survey of farmers conducted in August–September 2000.
Note: Sample farmers with serial numbers 8 and 10, each stored 10 maunds of purchased seeds in cold storages.

The majority of non-seed potato was sold immediately after harvest. The major reasons mentioned by farmers who sold potatoes just after harvest (including the cases after two weeks' drying) were the immediate need of cash for consumption, wage payment to hired laborers, and repayment of debts. It was the capital constraint that induced farmers to sell potatoes immediately. Besides, the relatively high market price in the harvest season in 2000/2001 also encouraged farmers to sell immediately.

Table IV shows that the farmers who sold potatoes immediately after harvest (A1), the price was 166 taka per maund on average, and a profit of 27 taka (income of 64 taka if the income from family labor and owned land is included) was accrued to them. In the case of sales after two weeks' drying (A2), they received 183 taka, with a profit of 36 taka and an income of 73 taka per maund. In these cases for the farmers who operated 0.4 acres for example, the income from non-

TABLE IV

ESTIMATION OF PROFIT AND INCOME FROM POTATO PRODUCTION FOR SAMPLED FARMERS IN 2000/2001

(Taka per maund)

	Non-seed Potato				Seed Potato	
	A1	A2	A3	A4	B1	B2
Number of samples	$N = 12$	$N = 11$	$N = 3$	$N = 7$	$N = 1$	$N = 7$
Gross revenue (= price)	166	183	231	260	179	400
Costs:						
Production costs	139	139	139	139	131	131
Marketing costs	0	8	13	109	8	124
Transport cost	0	0	0	3	0	6
Labor cost	0	0	0	0	0	8
Storage charge	0	0	0	80	0	80
Cost of bag	0	0	0	10	0	10
Loss of potato	0	8	13	16	8	20
Total costs	139	147	152	248	139	255
Net revenue (= profit)	27	36	79	12	40	145
Income	64	73	116	49	84	189
Standard deviation of net revenue	25.6	38.7	73.7	56.6		

Source: Prepared by the authors based on the sample survey of farmers conducted in August–September 2000.

Notes: 1. A4: Case of sales in August. Farmers usually sell receipts of stored potatoes to local traders in August.
2. Income includes returns to family labor and land in addition to profit.
3. U.S.$1 = 53 taka at the time of the survey.
4. Standard deviation of seed potato (case B2) is not estimated for considering the same expected price for seven samples.

seed potato production reached 3,700–4,200 taka, which is equivalent to about 50–60 days' wages for agricultural hired works in the village.

Some farmers (A3) stored potatoes at home for 2–3 months and received a price 26 per cent higher than that in the case of A2 and their strategy was very successful in the study year. However, the data shown in Figure 1 indicate that this strategy succeeds only in some years, while in other years farmers have to wait 2–3 months without obtaining any extra profit.

It can be concluded that in the study year potato farmers enjoyed an extra profit from the high price at the harvest season (and during 2–3 months after harvest), since the profit shown in Table IV should be zero on average in the long run, given the competitive land rental market.[27] However, it should be noted at the same time that the farmers received only 64–69 per cent of the price that urban consumers actually paid even in the absence of storage in cold storages.

On the other hand, farmers who stored potato in cold storages largely failed to obtain extra profit in the study year and actually lost if capital interest is taken into account (A4 in Table IV is the case of sale in August).[28] The high values in the standard deviation of net revenue in cases A3 and A4 indicate the higher risk involved in such transactions. It was revealed, in contrast, that the farmers who stored seed potato in cold storages (B2) were able to obtain a rather high profit. It should be noted, however, that the demand for seed potato is concentrated within a short period of one month during the planting season, so that marketing of seed potato involves a high price risk. Moreover, since seed potato is usually stored with non-seed potato in the same area in the cold storages, it may be affected by the diseases transmitted from non-seed potato.[29] There is no arrangement such as the discounts for advanced purchase in the case of seed potato. Usually rich farmers meet the major part of their seed demand by their own production (stored in the cold storages), supplemented by the BADC seeds. On the other hand, small farmers meet their demand by purchasing from the private market, taking into consideration the acreage of land they plant in the season. Therefore the market for seed potato is "thin" and short-spanned in nature. It is thus highly risky and not popular for farmers to seek profit in this business chance.

[27] If the interest for self-supplied working capital for potato production is taken into account, the profit should be positive. But if such interest is deducted from the profit, the profit is absorbed by the land rent and approaches zero on average, especially if we consider that the potato production technology is already sufficiently standardized.

[28] Assuming that the opportunity cost of interest is 3 per cent per month for five months of storage on average, it is estimated that the cost of working capital incurred by farmers is 21 taka per maund, so that farmers' profit becomes negative and the amount of loss reaches 9 taka per maund.

[29] There was one cold storage specialized in seed potato in Comilla City, but it was too far for the villagers to store potatoes there.

B. *Cold Storage Owners*

In total we interviewed three cold storage managers for obtaining information on the cost and return of their business. The capacity of these storages was 60,000 bags (= 120,000 maunds), 75,000 bags, and 100,000 bags and the realized capacity utilization in the study year was 100, 95, and 25 per cent, respectively. The extremely low capacity utilization in the last case was mainly attributed to the new establishment of the storage in the previous year.

Table V shows the cost and return of the first and the smallest storage, which is

TABLE V

ESTIMATION OF PROFIT AND INCOME OF A SAMPLED COLD STORAGE IN 2000/2001

	Total
Total amount of potatoes stored (maunds)	120,000
With loan	103,968 (86.6%)
Without loan	16,032 (13.4%)
Gross revenue (taka)	10,119,840
Costs (taka):	
Labor cost	1,700,000
Electricity cost	2,000,000
Depreciation cost	600,000
Cost of other inputs	755,000
Interest paid to bank[a]	1,386,240
Miscellaneous costs	550,000
Total costs (taka)	6,991,240
Net revenue (taka)	3,128,600
Interest for working capital (unpaid)[b]	266,933
Profit (taka)	2,861,667

Source: Prepared by the authors based on the sample survey of cold storage owners conducted in August–September 2000.

Notes: 1. The data of this table refer to cold storages with a storage capacity of 60,000 bags.
2. Depreciation costs are estimated on the basis of fifty-year life of cold storages. Note that the storage was constructed at the cost of 30 million taka in 1982.
3. Cost of other inputs include cost of oil, gas, repairs, etc.
4. Income includes net revenue and interest of own capital used for purchasing inputs and of depreciation cost.
5. U.S.$1 = 53 taka at the time of the survey.

[a] Cold storage owners borrowed credit from the bank at an interest rate of 16 per cent per year and used it for a period of ten months.

[b] Interest for working capital is estimated for an average period of four months (half of the total period of operation of cold storage), using 16 per cent per year interest rate as its opportunity cost.

considered to provide the most reliable figures. Cold storages provide 20,000–30,000 taka[30] (on average about 26,000 taka were received by the nine traders surveyed as shown later in Table VII) interest-free loans to the clients per 200 maunds (one truckload) of potatoes, but instead they impose a storage charge of 85 taka per maund, 5 taka more than the normal rate, regardless of the duration of the period of storage. Out of the total amount of stored potatoes in the storage, such a loan was provided for 87%. The higher storage charge can be considered to be the interest for loan. Under the assumption of a 8-month storage period from March to November, it appears that they provided clients with a 26,000 taka loan for an interest of 1,000 taka (5 taka/maund × 200 maunds) after 8 months, implying that the effective interest rate they charged was 5.8% per annum. The effective interest rate varies depending on the duration of the storage period, for example, 6.6% for 7 months, 7.7% for 6 months, 9.2% for 5 months, 11.5% for 4 months, 15.4% for 3 months, and so on.[31] On the other hand, cold storage owners usually borrow working capital from commercial banks at an interest rate of 16% per annum, under a special facility called "C.C. Loan" (cash in credit loan).[32] Therefore if the average duration of the storage period of the clients exceeds 3 months, credit arrangement by cold storage owners involves some interest subsidy to the clients.

The cost is comprised of labor cost (for managers and other officials, and unskilled laborers who shuffle stored potatoes), electricity cost, and others, the total of which was estimated to be 6,991,240 taka (58 taka per maund), if interest for self-financed working capital is not taken into consideration. In this case, the income accrued to the owner is 3,128,600 taka. If the opportunity cost for the self-financed working capital is taken into account, the profit amounts to 2,861,667 taka. The storage was established with a total of 30 million taka including a 20 million taka bank loan in 1982. Although the time interval since the establishment is too long to allow us to estimate the profitability of the initial investment, it appears that a net profit of nearly 3 million taka is a very large amount according to the present rural Bangladesh standard.

It seems that their business is risk-free under the fixed storage charge, irrespective of the duration of the storage period. However, cold storage owners are facing another type of risk. The high profitability of the cold storage business in general

[30] The amount of loan can be different among the cold storage owners depending on the advantage/disadvantage in the location and reputation for traders. The same cold storage owners, however, usually provide a higher amount of loan to traders who regularly store a large amount of potatoes.

[31] According to the supplementary survey, in 2001/2, the cold storage owners provided higher loans between 25,000 and 30,000 taka in order to attract traders who failed to get enough profit in the previous year.

[32] Under the cash-in-credit system, entrepreneurs can borrow any amount of working capital within their approved limit and can repay back any time within one year, paying interests accordingly.

induced more urban capital flow in this business, resulting in a fiercer competition in a narrow rural area. In 1998, it was reported that about thirty-two cold storages were in operation in Comilla District, probably with an excess capacity compared to the local production and that about 27 per cent capacity of these cold storages was unused [Modern Industries (Bangladesh) and Agricultural Marketing Department 1998]. The capacity utilization rate sometimes declines due to the unexpectedly low production at the local level.[33] They have to bear the risk of underutilized capacity. It is estimated that in the case of the studied storage with a capacity of 60,000 bags of potatoes, a capacity utilization of 63 per cent can only cover the variable costs and it can only provide a zero-profit level at a utilization of 69 per cent.

It can be considered that the supply of loan to clients is a measure to raise the capacity utilization of the storage facility, thus to increase profit. In contrast to the observation of Lewis (1991), presently, credit is supplied for maximizing the capacity utilization under increasing competition among the cold storage owners, and not for controlling traders and farmers.

C. *Traders*

Finally the potato traders' cost and return is estimated (Table VI), based on interviews with nine traders in total. In the "regular" trading business without involvement in storage, according to a case study conducted in March,[34] it was found that the margin accrued to the trader was 6 taka per maund, and if his own labor cost was deducted, the margin was reduced to 5 taka per maund. The rate of net margin (after deduction of the family labor cost), therefore, was estimated to be around 2–3 per cent. According to another trader's ledger book with a good relation with urban traders, capital can be revolved about forty times a year. In this case the rate of profit will be 80–120 per cent per annum or 7–10 per cent per month, which may be the highest rate. If the lower revolving rate of capital (due mainly to the late payment of urban traders) is taken into account, the rate of profit will decrease to about 3–5 per cent per month.[35]

On the other hand, Table VI also shows the cases of traders who purchased potatoes and stored them in cold storages. In the table in addition to the case of seed potato, two cases of non-seed potato are shown, in which traders withdrew

[33] The area of the cold storage is generally used by local traders, but in some years, it can be used by some nonlocal traders from other regions.

[34] We collected data from several traders. The data were found less reliable than in the case mentioned here and/or due to the lack of some crucial data, they could not be used.

[35] The net margin of 2–3 per cent is usually considered to be very low, which indicates the competitive nature of the market (for example, see Hayami and Kawagoe 1993), but there is no economic basis for determining whether the market is competitive or not by considering the net margin itself. In order to assess the market competitiveness, besides the net margin the revolving rate of working capital should be considered.

TABLE VI

ESTIMATION OF PROFIT AND INCOME FOR POTATO TRADERS IN 2000/2001

(Taka per maund)

	Regular Trading	Trading with Storage		
	Non-seed Potato	Non-seed Potato		Seed Potato
	In March	In July	In August[a]	B1[b]
Number of samples	$N = 1$	$N = 4$	$N = 8$	$N = 1$
Gross revenue (= price)	215	325	292	400
Costs:				
Purchasing cost	190	197	197	197
Marketing costs	20	125	128	132
Transport cost	2	3	3	6
Labor cost	4	8	8	8
Storage charge	0	85	85	80
Charge of commission agents	4	0	0	0
Traders' family labor share	1	11	11	13
Cost of bag	8	10	10	10
Loss of potato	0	6	9	15
Others	1	2	2	0
Total costs	210	322	325	329
Net revenue (= profit)	5	3	−33	71
Income	6	14	−22	84

Source: Prepared by the authors based on the sample survey of traders conducted in August–September 2000.

Notes: 1. Income includes returns to traders' family labor in addition to profit.

2. U.S.$1 = 53 taka at the time of the survey.

[a] Since the survey was conducted in late August to early September, we could not make an estimation based on price information in October.

[b] Gross revenue shows traders' expected price for trading of seed potato.

potatoes in July and August, respectively. As the table shows, in the study year 2000/2001 although traders who sold potatoes in July received a small amount of profit, they incurred a loss when they sold them in August since the potato price unexpectedly decreased from 325 taka in July to 292 taka in August. According to the supplementary survey conducted in April 2002, it was revealed that with the exception of seed potato traders could not obtain enough profit, or sometimes they incurred a loss from the investment in potato storage in the study year.

Traders need a large amount of working capital even if they operate the "regular" trading because they have to pay farmers immediately or within a week after receiving potatoes but they have to wait for about fifteen to thirty days until the urban traders pay them in turn. For such a "regular" transaction, traders can sup-

ply a part of the capital by themselves but have to borrow the other parts from relatives with interest (in the form of profit sharing, as discussed later).

In addition, if traders invest in the potato market by keeping potatoes in cold storages for several months, the necessary working capital will be much higher. Table VII shows the traders' required working capital for storing potatoes in cold storages. Even if the traders can benefit from the loans from cold storages as mentioned above, only about two-thirds on average of their total needs can be covered, considering the mere fact that they purchased potato from farmers at about 190–200 taka per maund but received a loan of only 130 taka per maund (26,000 taka per 200 maunds) from the cold storage owners. Since the amount of stored potatoes of the sample traders ranged from 210 to 3,240 maunds, with an average of 1,625 maunds, the shortage of working capital was 26,200 to 311,620 taka, with an average of slightly more than 110,000 taka, as shown in the table. The commercial banks could provide only a small part of this necessary working capital.[36] As a result, nearly 100,000 taka of capital on average were basically self-financed, although a part of which was provided by relatives on a profit-sharing basis. Transactions of informal credit, therefore, facilitate various investments in rural areas including potato trading.

TABLE VII

REQUIRED WORKING CAPITAL FOR TRADERS FOR POTATO STORAGE

Sample Traders' Serial Number	Total Amount of Stored Potatoes (Maunds)	Average Purchase Price (Taka/Maund)	Required Capital (Taka)			
			Total (a)	Credit from Cold Storage Owners (b)	Capital Which Should Be Met (a−b)	Credit from Institutional Sources (c)
1	210	220	46,200	20,000	26,200	20,000
2	600	184	110,400	90,000	20,400	5,000
3	846	184	155,664	120,000	35,664	15,000
4	1,200	195	234,000	126,000	108,000	0
5	1,350	175	236,250	138,000	98,250	0
6	2,095	184	385,480	300,000	85,480	85,480
7	2,260	200	452,000	360,000	92,000	0
8	2,822	210	592,620	281,000	311,620	6,000
9	3,240	220	712,800	480,000	232,800	9,000
Average	1,625	197	325,046 (100%)	212,778 (65%)	112,268 (35%)	15,609 (5%)

Source: Prepared by the authors based on the sample survey of traders conducted in August–September 2000.

[36] Some traders received credit from commercial banks, but they were basically crop loans for large farmers. Considering the fungibility of money, however, it seems that a part of such loans is also used as working capital for the potato trading business.

V. POTATO MARKETING UNDER CAPITAL CONSTRAINT AND RISK

Next, the economic analysis on the potato market in the study area will be expanded, taking into consideration the year-to-year fluctuations (Table VIII). The table shows the results of a simulation for the rate of return to investment in the potato market by traders during the last ten years. The wholesale price (national average) of potatoes in March and November in the urban consumer areas was used for estimating the "maximum" seasonal price differential for non-seed potato in each year.[37] The "paid-up costs" are the necessary costs for marketing potato, starting from collection from farmers, storage in cold storages, removal from storage and finally sales to urban traders, and several assumptions were made in the estimates. First, according to Lewis (1991), the storage charge of potato per maund in the same area was 55 taka in 1986/87, compared to 80 taka in 2000/2001. Thus we assumed that the (nominal) storage charge increased gradually at the same rate every year from 1986/87 to 2000/2001. Second, for the remaining parts of the "paid-up costs," comprised of transportation cost, hired labor cost, cost of raw materials (such as bags), etc., we assumed that these costs increased proportionally with inflation, for which we used CPI (national) as deflator.

The rate of return estimated in the table will be analyzed. In the study year 2000/2001, the rate of return was only 1.2 per cent, which is consistent with the conclusion mentioned earlier that those who invested in the potato market such as traders, failed to obtain sufficient profit in that year. It is also clear that the rate of return fluctuates largely year-by-year, from the lowest value of –4.0 per cent in 1997/98 to the highest value of 16.1 per cent in 1993/94. The average value was 5.8 per cent for the last ten years and if we confine for the last five years, the value was 2.8 per cent. Regression analysis shows that the rate of return (y) displays a time-series trend as follows;

$$y = 10.33 - 0.83t, \quad R^2=0.196, \text{ with } t\text{-values in parentheses.}$$
$$(2.796)\ (-1.396)$$

Thus the rate of return declined at a rate of 0.83 per cent per year for the last ten years from 1991/92 to 2000/2001, although the results were not sufficiently significant. The p-value is estimated to be 0.1727, which indicates that the hypothesis of declining trend cannot be verified at a level of 17.3 per cent. Moreover, if the data of 2000/2001 are omitted, the declining trend will be less evident. How-

[37] This implies that the margin obtained by the urban traders is also included in the price data. However, since the margin of the urban traders is fairly stable according to the authors' observation, it can be neglected, so far as the (seasonal) price differential is concerned.

TABLE VIII

ESTIMATION OF PRICE-DIFFERENTIALS AND NET RATE OF RETURNS FOR TRADERS, 1991/92 TO 2000/2001

Year	Price of Non-seed Potato (Taka/Maund)			Adjusted Paid-Up Costs (Taka/Maund)			Net Price Differentials	Rate of Return (% per Month)	Average Amount of Stored Potato (Maunds)	Traders' Income (Taka)
	In March (a)	In November (b)	Price Differentials (c) = (b)−(a)	Cold Storage Charge	Other Costs	Total Costs (d)	(e)=(c)−(d)	(f)=(e)/(a)/8×100	(g)	(h)=(g)×(e)
1991/92	116	284	168	59	30	89	79	8.5	1,625	128,375
1992/93	128	303	175	61	31	92	83	8.1	1,625	134,875
1993/94	141	419	278	64	32	96	182	16.1	1,625	295,750
1994/95	171	301	130	66	35	101	29	2.1	1,625	47,125
1995/96	132	333	201	68	38	106	95	9.0	1,625	154,375
1996/97	192	338	146	70	38	108	38	2.5	1,625	61,750
1997/98	175	233	58	73	41	114	−56	−4.0	1,625	−91,000
1998/99	159	331	172	75	45	120	52	4.1	1,625	84,500
1999/00	173	436	263	77	47	124	139	10.0	1,625	225,875
2000/01	202	348	146	80	47	127	19	1.2	1,625	30,875
Average	159	333	174	69	38	108	66	5.8	1,625	107,250
Average of 1996/97 to 2000/2001	180	337	157	75	44	119	38	2.8	1,625	62,400
Standard deviation of average	29	60	64	7	6	13	66	6	0	107,690

Sources: For market price of potato during the period from 1991/92 to 1994/95, Modern Industries (Bangladesh) and Agricultural Marketing Department (1998) and from 1995/96 to 2000/2001, BBS (various issues). For the consumer price index, data from Bangladesh Bureau of Statistics, quoted in Bangladesh Bank web site, www.bangladesh-bank.org. For cold storage charge, Lewis (1991).

Notes: 1. Paid-up costs indicate costs of marketing, excluding interest of working capital.

2. Cold storage charges are adjusted proportionately based on the information of Lewis (1991), while "other costs" are adjusted by using the national consumer price index from 1991/92 to 2000/2001.

ever, based on the interviews with traders, the rate of return in 2001/2 was as low as that in the previous year (no official statistics are available presently). Therefore we have no special reason to omit the data in 2000/2001.

The possible reasons for this slightly declining trend are first, the increased supply of chilled potatoes in accordance with the increase in the number of cold storages,[38] and second, the increased supply of HYV potatoes from northern Bangladesh which competes with chilled potatoes in the Comilla region, especially after the completion of the Jamuna Bridge in 1997. And third, the increased supply of vegetables other than potatoes in recent years, which can be substituted for potato.

Assuming now, for example, that traders behaved in the year 2000/2001 bearing in mind the previous three years' market conditions, it appears that the reference rate of return was 3.3 per cent (the average of three years from 1997/98 to 1999/2000). The table also shows a simulation on how much income was accrued to traders who stored 1,625 maunds of potato in cold storages: the values ranged between −91,000 and 295,750 taka with a ten-year average of 107,250 taka (62,400 taka for the last-five-year average). It should be noted here again that these figures are the "maximum" for potato storage from March to November.

It should be recalled that about two-thirds of the required working capital for the traders were met by the loan given by the cold storage owners (Table VII). And the effective rate of interest for this portion of credit was estimated to be 5.8 per cent per annum, or 0.48 per cent per month in the case of eight-month storage during March–November (0.55 per cent per month for seven-month storage, and 0.64 per cent per month for six-month storage). The interest rate of credit from "non-self-supplied" credit should be only slightly higher than this volume, even if institutional loans from commercial banks with 16 per cent per annum interest rate[39] are taken into account, because their share is very small. Therefore, it can be concluded that the investment in the potato market, given the existence of "cheap" credit supply from the cold storage owners,[40] is profitable in spite of its slightly declining trend and high risk. The remaining issues are to determine how traders raise working capital, which cannot be met by the cold storage loans and how much is the (opportunity) cost of such capital.

[38] It is possible that the increasing competition among cold storage owners can lead to a discount of the storage charge, thereby the rate of return for traders cannot be adversely affected. However, it can be considered that the cold storage owners adopted a strategy whereby the storage charge was not discounted, but instead cheaper credit would be supplied to the traders. According to the interview with some cold storage owners, they provided on "interest-free" credit equivalent to only 30 per cent of the potato value in the 1980s, but now equivalent to about 67 per cent of the value.

[39] In 1999/2000, Bangladesh Krishi Bank (BKB), a specialized agricultural development bank, supplied working capital at an interest rate of 14 per cent per year.

[40] Some cold storage owners even provided transport facilities to carry potatoes from harvest areas to cold storages.

The general situation of the credit market in the village will be presented. Villagers can borrow credit informally either through long-term or short-term credit contract. Under the long-term credit contract, borrowers can receive about 100,000 taka by mortgaging out one acre of land and the tillage right of the land is transferred to the lenders until the debt is paid off. The effective interest rate for such a transaction is estimated at 15.3 per cent per year.[41] Under this system, the borrowers are mainly the large and medium landowning households including potato traders, and they use the money for purposes such as working abroad and purchasing land. Interestingly the major lenders in this transaction are the landless and small landowning households who have stable income sources from off-farm employment. In the study year a total of 1.11 million taka (for 106 households in the village) was transacted in this market, of which 78 per cent was borrowed by the large and medium landowning households. In the short-term credit transaction, on the other hand, credit was transferred for a short period of time, not more than a year. A total of 3.42 million taka (for 106 households) was transferred from lenders to borrowers, of which the large and medium landowning households borrowed 70 per cent. They borrowed in the short-term credit market mainly for business purposes, as presented later, while the landless and small landowning households borrowed especially for working abroad and for consumption purposes. In general, it was found that the households in the lower strata did not depend on the households in the upper strata for credit, rather the reverse credit supply from the lower strata to the upper strata was observed.[42]

Table IX shows the outstanding short-term debts and the purposes of borrowing for the 106 households surveyed during June–July 2000. It appears that out of the total short-term debts of 4.92 million taka, 70 per cent originated from informal sources (including two ASCRAs, accumulating savings and credit associations[43]) while 30 per cent originated from the commercial banks and NGOs.[44] It is also observed that although the landowning households with more than 1.50 acres obtained a 84 per cent share of the total formal credit, credit from the informal

[41] Under the mortgage system, mortgagees provide usufructuary right on land to mortgagers until the debt is paid off, implying that the amount of interest for credit is equivalent to the land rent. Considering that the rent amounting 13,300 taka per acre is paid in advance in the village, the rate of return can be estimated by solving the formula, $100{,}000r = 13{,}300\ (1 + r)$, where r is the rate of return.

[42] The increased circulation of money in rural areas with reversed flow from the poor to the rich is presented in Fujita (2000).

[43] The ASCRAs (*samity*) existed in the east and middle *para* were Ashora Samity and Jubaka Samity. The Ashora Samity, comprised of a total of seventy-seven members in April 2002, collects 10 taka from every member per week and uses the accumulated money for lending at 16 per cent per annum interest. The money is also invested in land mortgage and rent out the land to get land rent.

[44] NGOs such as the Grameen Bank and the Pace Foundation were operating in the village, although on a rather limited scale.

TABLE IX

BORROWING OF SHORT-TERM CREDIT AND ITS UTILIZATION

Land Owning Household Category (Acres)	Total Number of House-holds	Source of Credit	Total Amount of Debt (Taka)	Total Number of Transac-tions	Utilization (Percentage Distribution)									
					Consump-tion	Recon-struction of Houses	Land Lease	Going Abroad	Crop Production	Purchase of Cows	Potato Trading	Other Trading Business	Repayment of Old Loan	Total
0	27	Formal	24,040	4	25	25	0	0	25	0	0	25	0	100
		Informal	319,085	38	47	8	5	21	3	5	0	8	3	100
0.01–0.49	40	Formal	26,300	3	0	33	0	0	33	34	0	0	0	100
		Informal	705,880	58	53	7	0	16	14	2	5	3	0	100
			(579,880)	(56)	(56)	(7)	(0)	(16)	(14)	(2)	(2)	(3)	(0)	(100)
0.50–1.49	25	Formal	186,960	10	20	20	0	0	60	0	0	0	0	100
		Informal	798,685	32	41	12	0	0	19	3	25	0	0	100
			(160,685)	(26)	(50)	(15)	(0)	(0)	(23)	(4)	(8)	(0)	(0)	(100)
1.50–	14	Formal	1,258,000	7	0	0	0	14	58	0	14	14	0	100
		Informal	1,598,200	19	5	11	0	0	0	0	79	0	5	100
			(153,200)	(7)	(14)	(29)	(0)	(0)	(0)	(0)	(43)	(0)	(14)	(100)
Total	106	Formal	1,495,300	24	13	17	0	4	50	4	4	8	0	100
		Informal	3,42,1850	147	43	9	1	12	10	3	18	3	1	100
			(1,212,850)	(127)	(50)	(10)	(1)	(13)	(12)	(3)	(5)	(4)	(2)	(100)

Source: Prepared by the authors based on the baseline survey conducted in June–July 2000.

Note: 1. Formal credit indicates those from formal financial institutions such as banks, NGOs.

2. Figures in the parentheses are the cases in which credit from cold storage owners for potato storage is excluded.

3. U.S.$1 = 53 taka at the time of the survey.

sources was larger even for them (if loans from cold storage owners are included). And actually for the potato traders, although the majority of them were large landowners as well, institutional credit accounted for a rather small share (5 per cent) of their working capital for potato trading (Table VII). Moreover, the fact that nearly 80 per cent (even if we exclude loans from the cold storage owners, it is still as much as 43 per cent) of credit from the informal sources for large landowning households was used for potato trading is particularly evident in Table IX.

Table X shows the interest rate distribution for such short-term informal credit transactions in the village (excluding the "interest-free" loan from the cold storage owners). The table shows that the interest-free credit (locally called *haulat*) was dominant, accounting for more than 90 per cent of the total transactions reported. Out of the total 114 interest-free credit transactions, 29 (25 per cent) included the unpaid money to grocery shops or input dealers' shops (accounts payable). And out of the remaining 85 cases, in 22 cases (26 per cent) the loans originated from the fathers-in-law and relatives mostly staying outside the village and in 63 cases (74 per cent) from other relatives and friends, mostly residing in the village (sometimes from the colleagues working in the same factory). Dreze, Lanjouw, and Sharma (1998) reported that in their study village Palanpur in Uttar Pradesh, India, the majority of interest-free loans originated from outside the village and especially from the fathers-in-law, which has a specific social meaning in the village exogamy custom in terms of patriarchal norms. In our study village, although the significance of such credit from the fathers-in-law was much lower, still it was one of the important sources of credit with free interest.

However, for the credit received for the purpose of potato trading, it appears that all the cases involved a positive interest, although no explicit interest was imposed and instead profit-sharing was adopted.[45] As an example, a trader interviewed borrowed 30,000 taka during the harvest season and repaid it back after five months, and enjoyed a profit of 5,000 taka, half of which was shared with the lender (or more correctly speaking, with the coinvestor).[46] Besides such profit-sharing contract, in several cases positive interest was involved as shown in Table X; i.e., four cases for consumption purposes (including marriage and medical expenses, etc.), one case for crop production, international migration, and repayment of old loan, respectively. And the distribution of the interest rates was as follows; two cases for less than 5 per cent per month, one case for 5 per cent per month, and four cases for 10 per cent per month.

In conclusion, it is difficult to fix the opportunity cost of self-supplied capital for traders, considering the widespread existence of free-interest informal credit

[45] In the Muslim rural society, money lending with profit-sharing is more acceptable than that with fixed rate of interest.

[46] Since the rate of profit in this case was 3.4 per cent per month, realized interest rate for the lender was 1.7 per cent per month.

TABLE X

INTEREST-WISE DISTRIBUTION OF SHORT-TERM INFORMAL CREDIT

Purposes	Average Amount of Debt (Taka)	Number of Transactions	Interest-wise Distribution					
			0% per Month	Less Than 5% per Month	5% per Month	10% per Month	Profit Share:1/3	Profit Share:1/2
Consumption	2,940	63	59 (23)	1	0	3	0	0
Reconstruction of houses	8,573	13	13 (1)	0	0	0	0	0
Crop production	2,168	15	14 (2)	1	0	0	0	0
Purchase of cows	4,025	4	4 (0)	0	0	0	0	0
Land lease	2,500	2	2 (0)	0	0	0	0	0
Going abroad	32,171	17	16 (0)	0	0	1	0	0
Potato business	36,667	6	0 (0)	0	0	0	2	4
Other trading business	17,497	5	5 (3)	0	0	0	0	0
Repayment of loan	4,100	2	1 (0)	0	1	0	0	0
Total	12,128	127	114 (29)	2	1	4	2	4

Source: Prepared by the authors based on the baseline survey conducted in June–July 2000.
Notes: 1. Figures in parentheses indicate cases of "unpaid dues to shops."
2. For the profit share, "1/3" and "1/2" mean the share accrued to coinvestors.
3. Credit from cold storage owners for potato storage is excluded in this table.

of specific type and of only a few cases with explicit positive interest. However, it appears at least that the average rate of return of 2.5–3.6 per cent per month, even under the fairly high risk involved, is adequate for traders, especially when taking into account the large amount of "cheap" (less than 1 per cent per month) credit supply from the cold storage owners.

In this case the last question is why farmers and cold storage owners do not invest in the potato market on a large scale. First, let us consider the case of the farmers. Actually many of them stored non-seed potato in cold storages as illustrated in Table III, but in a much smaller amount (6–100 maunds, with an average of only 27 maunds) compared to traders who stored 1,625 maunds on average. As mentioned earlier, farmers are facing serious capital constraints, because of their requirement of capital, especially for the three cropping of rice that follow potato cultivation. However, as indicated by Lewis (1991) (and according to the author's interviews also), during the late 1980s they were actively participating in the investment in the potato market by receiving credit from cold storage owners, but thereafter they gradually lost interest in the investment. Why? One of the basic reasons might be the increased market volume for potatoes in the urban and semi-urban areas. Trading with urban traders (*paikar*) which requires more time and "skill" (including the so-called social capital for establishing and maintaining trade networks) for meeting the more sophisticated and much larger

market demand for potato, presently cannot be conducted easily by the farmers as a part-time job. The slight trend of declining rate of return can also be one of the causes.[47]

Second, why did the cold storage owners, as mentioned earlier, cease to invest in the potato market by the time of our survey and why did they concentrate on their business with fixed storage charge? It can be assumed that it is presumably for the same reason as that mentioned above; i.e., the increased market demand for potato presently requires more skill and time in trading, which cannot be easily conducted by unspecialized traders such as the cold storage owners. At the same time, due to the increased competition among the cold storage owners, the owners tended to place emphasis on reaching the capacity of the storages. Cold storage owners arrange a special party for traders in February on which occasion they announce the storage charge and the amount of loan they offer to traders for capturing the traders' response, taking into consideration the conditions offered by the other cold storage owners. Even after loading of potatoes, they have to monitor the market price and the rate of unloaded amount of potatoes in successive months until November. They also have to reissue receipts whenever the owner of the stored potatoes changed. Therefore, they are very busy in their operations and it would be difficult for them to participate in the more sophisticated potato trading on a large scale.

VI. CONCLUSIONS

This paper focused on potato marketing in rural Bangladesh, including the intertemporal marketing with several months' storage, based on a recent village case study in Comilla District. A detailed economic analysis was conducted by presenting cost and return data obtained from farmers, traders, and cold storage owners for the survey year 2000/2001. The analysis was extended also to the last five to ten years, taking into consideration the large year-to-year fluctuations of the potato market. The pioneering study of Lewis (1991) on the potato market in the same region in the latter half of the 1980s is a good benchmark for the present study to understand the structural changes of the market that have occurred since then. The enumeration of all the households residing in two hamlets as a baseline survey enabled us to investigate the rural employment structure and credit market at present as a whole, which facilitated the analysis of the relations between farmers, traders, cold storage owners, and other agents in the potato market. As a concluding remark the major findings and their implications are presented below.

First, in contrast to the situation in the late 1980s the various agents in the po-

[47] The investment in agricultural machinery such as tractors and shallow tubewells became more popular for large landowning households in the 1990s.

tato production and marketing system in rural Bangladesh, particularly farmers, traders, and cold storage owners, became more "specialized" in production, marketing, and provision of storage services, respectively. In this process of change, mainly the traders (*bepari*) are presently investing in the inter-temporal marketing of potato, bearing a rather high risk, although the so-called stockiests who sell and purchase receipts play also some important roles in the market. The cold storage owners, who once dominated the market through the extension of credit to farmers and traders in the 1980s, have discontinued such operations, and are presently concentrating their activities on the storage business with a fixed charge. They are still providing a large amount of loans to clients (traders), but the major purpose changed to reach maximum capacity utilization of their storage facilities. The argument of Lewis that the scarcity of capital for rural people lead them to depend on urban agents (cold storage owners) for getting capital, which generate interlinked networks between technology owners and users, and that in the long run a "dependent capitalism" will emerge in developing countries including Bangladesh, does not apply to the present situation in rural Bangladesh.

Second, a broad-based economic development in rural Bangladesh contributed to the change in the potato market structure. In particular, the expansion of off-farm wage employment opportunities for the lower-strata people raised and stabilized their income level substantially, and presently it is not necessary for them to rely on informal credit supply from the upper-strata villagers and the urban rich people for potato production. But at the same time small farmers do not have enough capital to participate in the potato storage business because of the increased cropping intensity and the increased need to purchase inputs for cultivation.

Third, it seems that the tendency to "specialization" of various agents in the potato market, as mentioned above, can also be attributed to the development of the potato consumers' market in urban and semi-urban areas, which requires more time and "skill" (including the establishment and the maintenance of trade networks) in the transactions with urban traders (*paikar*) for meeting the more sophisticated and much larger demand for potato, although this is still a hypothesis that should be verified in the future. In addition, it is possible that due to the slight trend of declining rate of return to the investment in the potato market, which brought about an emergence of scale economies, small transactions by farmers became uneconomical. The fact that the increasing competition among the cold storage owners led them to make more efforts to concentrate on reaching the capacity of the storages can also be an important factor for the withdrawal from potato inter-temporal trading.

Fourth, the rate of return to investment in the potato market largely fluctuates year-by-year, but it showed a slight trend of decline during the last ten years. Still it is estimated to have amounted to be 2.8 per cent per month for the last five

years on average, which is "adequate" even under rather high price risks, given the large amount of "cheap" (less than 1 per cent per month) credit supply by the cold storage owners. (In other words, the access to institutional credit from commercial banks is by and large limited to the urban-based cold storage owners, but is transferred effectively to traders.) We basically agree with the argument of Mahmud, Rahman, and Zohir (2000) that the high profitability is more or less cancelled out by the high price risks involved, although further studies on this point should be carried out in the future, especially to determine how to evaluate risk premiums under the lack of insurance market.

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