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BANGLADESH FOOD MARKET PERFORMANCE: INSTABILITY, INTEGRATION AND INSTITUTIONS

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List of Abbreviations and Acronyms

ACF	Autocorrelation Function
ARCH	Autoregressive Conditional Heteroskedastic model
ARIMA	Auto-Regressive Integrated Moving Average
BBS	Bangladesh Bureau of Statistics
BIDS	Bangladesh Institute of Development Studies
DAM	Department of Agricultural Marketing
FAO	Food and Agriculture Organization
FFW	Food For Work
FPMU	Food Planning and Monitoring Unit
GARCH	Generalized Autoregressive Conditional Heteroskedastic model
HIES	Household Income and Expenditure Survey
IFPRI	International Food Policy Research Institute
LOP	Law of One Price
NGO	Non-Government Organisation
OMS	Open Market Sale
PACF	Partial Autocorrelation Function
TT	Telegraphic Transfer
VAR	Value at Risk
VGD	Vulnerable Group Feeding
WAPDA	Water and Power Development Authority

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Executive Summary

Introduction

Food markets in Bangladesh have behaved very erratically in recent years, in part due to global factors related to the changing nature of demand. Domestic factors have also been blamed for sharp, often inexplicable food price rises, generally attributed to the anti-competitive behaviour of key market actors like millers and aratdars. The key focus of this study is on food market performance with a particular emphasis on the rice economy. It consists of the following:

1. Instability in Food Prices and Production over Time: This part provides context to the subsequent discussion on market performance, and includes analysis of production and price instability and seasonality (over 1973-2008).

2. Market Analysis: This part revisits market performance – market structure, costs and margins across value-chains; and market integration across domestic markets and with the cross-border economy.

3. Market Institutions: This part explores the mechanisms of exchange, especially over longer distances, and the informal institutions and trading networks that underpin complex forms of trade.

Methodology

The first sub-theme is explored using secondary data on prices, production and availability to assess year-to-year instability over time, using an appropriately specified ARIMA model. Seasonality is investigated using seasonal indices. The focus of this analysis is mainly on the instability of production, prices and consumption of food grains.

The second sub-theme conducts detailed investigations of market integration, vertical and spatial, using cost-margin

analysis and cointegration methods. The markets for rice, potato and brinjal were analysed.

The third sub-theme examines market institutions that are essential for proper functioning of competitive markets, i.e. those that enable smooth, unfettered transactions to take place in an atmosphere of safety, security and trust, especially of complex transactions over time and distance, domestically and internationally.

The micro level impact and consumption adjustment due to sharp changes in food prices was captured, using focus group discussions and household data for before-after sharp price changes, in two areas – a food surplus area and a deficit area.

Instability

There were noticeable fluctuations in rice production between years, especially in the 1970s, less fluctuation during the period beginning from the early 1980s to mid-1990s, and again more fluctuation during the period after. Seasonality analysis also illustrates a significant seasonality in production of rice in Bangladesh. Fluctuations in rice prices appear to be due to both random and non-random elements.

Results show a clear upward trend in real rice price during 1995 till 2008 with noticeable fluctuation between the years. There also exists noticeable seasonality in rice price that shows February/March and September/October as peak and May/June as the trough.

No systematic relationship between domestic production and prices of rice in the local markets was found. This is also confirmed in a multivariate analysis, which, however, shows a significant but perverse impact of the operations of the public food distribution system (PFDS).

Regarding other food items—potato and brinjal—results show a secular increase in production of both potato and

brinjal during the period beginning from the early 1970s to mid-1990s and a sharp increase afterwards. It is also observed that fluctuation is more pronounced in recent years compared to previous years. Prices of potato and brinjal (both in nominal and real terms) have also gone up during the period 1995-2008. Like production, prices have also increased at a faster rate in recent years compared to the previous years. Partial correlation exercises of rice price seasonality with that of potato and brinjal demonstrate that while potato price seasonality offsets rice price seasonality (i.e., negative correlation between the two), brinjal price seasonality accentuates it.

Market Integration

While growers' share in the final consumer price is less than 50 per cent for brinjal, it is about 70 per cent for potato and rice. While the shares of market operators are evenly distributed for potato and rice, it is highly concentrated among wholesalers and retailers for brinjal.

Recent econometric approaches for measuring spatial market integration have focused on testing two important hypotheses: the existence of the law of one price and market dominance. Given cointegration between divisional-hinterland prices and hence market integration, two hypotheses are of interest: first, the hypothesis of perfect market integration where a price increase in one market leads to an equivalent effect in another, and second, the hypothesis of market dominance where causality is unidirectional. Previous studies of rice market integration in Bangladesh concluded that there is limited integration. In contrast, a more nuanced picture is found with potato markets being well-integrated, rice markets generally well-integrated save for some specific locations, and brinjal markets poorly integrated.

Market Institutions

Agricultural markets are apparently complex but basic exchange mechanisms are simple. The key institution in the market is the aratdari system, especially for (non face-to-face) stranger-transactions. All the three markets examined (rice, potato and brinjal) exhibit a local circuit and a long-distance circuit. In the case of paddy-rice, the local circuit is dominated by traditional micro-processors responding to local demand and tastes, and surviving through product differentiation. The longer circuit is dominated by modern rice millers catering to deficit areas and large, urban centres. The exchange modalities are similar but the scale and terms of exchange differ depending on nature of risks faced.

Trust-building and personalised transactions are keys to successful exchange relations. Once trust is built, repeated transactions dominate exchange–new partners are introduced slowly and gradually. There are some supportive norms and institutions like samitis along with loyalty inducing values including a reliance on contracts. The market culture is conducive to building trade rapport quite quickly and for quick, verbal dissemination of information, e.g. on reputation.

Formal legal institutions to enforce contract are non-existent; judicial recourse is not commonly available as contracts are verbal. In terms of information, the weakest link is between consumers and retailers, as transactions are one-off, especially in urban centres, thus encouraging snatch (i.e. supply of sub-standard goods at a higher price). Only larger, institutional consumers (like restaurants) dealing with the same set of suppliers can avoid this problem.

The market has become less tied and therefore more equitable. Bargaining power, however, remains an important price-fixing element in exchange that gives advantage to the superior party.

Micro-level Adjustments to Price Shocks

Price instability has a cost, and poor households try to adjust through complex mechanisms. In surplus rice producing areas with a good boro harvest, these adjustments were found to be easier as wages responded to high prices, the harvest itself stabilised rice prices while, at the same time, generating broad-based demand in the economy for a variety of trade, services and other employment. In non-green revolution, single crop areas like Noakhali (especially chars) the adjustment process was found to be much harder with the poor having to devise complex responses to stave off hunger. The main point is that for large parts of the country (i.e. where rice production is good), the problem of high prices is transitory with adjustments in the labour market and the overall economy occurring quite rapidly. The concern is with backward areas where micro-level adjustments are indeed costly, and where the local economy is unable to adjust so well. The policy implication is clear: it is important to design safety net programmes and development interventions, especially for backward areas like chars, haors and lowland zones where the impact of high prices is severe.

Areas for Further Research

- The price-production relationship for rice needs more detailed analysis.
- There is a presumption that seasonality in food prices declined in the 1980s but may have become aggravated in recent years. This needs to be verified as it has implications for PFDS operations.
- The finding of bidirectional causality of Bangladeshi and Indian rice prices requires further investigation.
- For rice, some areas appear not to be well integrated— these need to be identified and characterised. It is likely that these are the more backward, single-cropped areas.

- The modern food retailing sector is in its infancy. The trade off between this sector and the traditional sector needs to be understood.
- The single biggest threat to trading is default—its nature, extent and redressal mechanisms need to be examined in depth to identify remedies.
- The aratdari system has been identified as the central pillar of the market. The task now is to promote this as a modern corporate entity. How can this be done?
- How to generate low cost consumer information that will reduce information asymmetry, especially at the interface with the retailer?
- Need to examine alternative shock-scenarios, the need for domestic stocks and costs compared to a strategy that depends more on a combination of stocks and imports to address food crises.

CHAPTER 1

INTRODUCTION

The profound transformation of the Bangladesh food regime taking place over the last three decades is well documented (e.g. Ahmed, Haggblade and Chowdhury 2000). Indeed, the very success in achieving near food self-sufficiency, stable prices and steadily rising real wages and farm incomes ushered in a sense of complacency with the food security regime in the country. Much of the success was attributed to reforms in the agricultural sector, including dramatic cuts in subsidy, streamlining of the public food distribution system (PFDS) and re-aligning market incentives to raise efficiency and growth. These changes were synchronized with the opening up of markets through trade liberalisation and allowing the private sector to import agricultural inputs as well as outputs—an activity which was previously a public sector monopoly. In general, these market-friendly reforms were warmly applauded and appeared to have been successful (Ahmed, Bakht, Dorosh and Shahabuddin 2007). The "losers" were to be compensated through expanded social safety nets like the vulnerable group development (VGD) and food-for-work (FFW) programmes, bolstered by the open market sale (OMS) of rice and wheat, to stabilise prices and consumption.

A critical factor underlying improved national food security of the post-structural reforms period was the role played by the existence of massive grain stocks in India and ease of private imports from Indian suppliers. In effect, the Indian stocks served as a buffer for

Bangladesh, helping to stabilise supplies quickly when faced with short crops. At the same time, large acreage expansion of boro rice under irrigation contributed to the reduction in intra-year price variability and reduced seasonality.

Recent events, however, tend to show that the hard-earned gains may be in danger of being reversed. Food price led inflation exacerbated by both domestic and international factors has been a recurring factor since 2006. While good harvests and a crash in global food prices tamed inflationary pressures in the wake of the global financial crisis in 2008, inflationary pressures re-emerged again in 2010-11. Once world market recovers from its current slump in the wake of the European debt crisis and slow growth in the US, Japan, India, and China, global food markets could once again be in turmoil leading to further instability in domestic food markets.

The initial sense of panic with high food prices began to abate after the bumper boro harvest of 2008. After another good harvest in aman 2008 and the prospects of a good crop in boro 2009, the market for rice began to stabilise. At the same time, the global recession set in, causing world and regional food prices to drop sharply. The combined effect of good domestic harvests and low world prices caused a slump in rice prices, even during the traditionally peak pre-harvest price period of March-April. Conversely, post-harvest rice prices in November-December 2009 remained high even though production levels were considered good, fuelling speculation that the rice market was being controlled by a "syndicate."

In other words, the food market has been experiencing periods of sharp booms and busts, causing acute worry amongst policy makers who appear unsure

about the way forward. Food prices remain a highly sensitive issue in the country.

Stabilisation policies, however, are difficult to manage, having to strike the right balance between opposing or contradictory interests (e.g. of consumers, producers and traders). Further, price stabilisation, usually within a well-defined band, is costly requiring large publicly held reserves with all the attendant problems of managing a complex PFDS. The most efficient option would be, of course, if the market could be relied upon to ensure price stability. While the foodgrain market, in general, is thought to be well-functioning, there have been concerns that price instability is sometimes artificially generated by unscrupulous traders taking advantage of structural flaws in the market itself.

However, complex policy decisions cannot be based on populist analysis of the food regime but require a systematic and careful analysis of the nature and causes of instability and implications for the market. Household and individual-level responses and adjustments to shocks, especially by those who are thought to be at particular risk, also require examination. This study addresses itself to this challenging task.

Thus, the overall theme of this study is food market performance with a particular focus on instability, integration and institutions. It is based on the experience of 2007-08 in Bangladesh when food prices assumed crisis-proportions to answer the question of whether domestic market failure can be held primarily responsible for the volatility seen at the time. The study also attempts to examine the impact of price volatility on household level consumption, and the manner in which

micro-level adjustments occur. The study therefore consists of three sub-themes as follows:

(a) Instability in Food Prices and Production over Time: This part provides context to the subsequent discussion on market performance, and includes analysis of production and price instability and seasonality (over 1973-2008).

This section tracks instability in production and prices of selected food items and assesses their impact on household food consumption. Although Bangladesh achieved near self-sufficiency in food production and stability in prices over the last three decades, this has been marked with periods of acute instability and heightened seasonality. In particular, the abrupt rise in the price of staple foods in recent years led to a deteriorating food security situation with obvious implications for household food consumption, particularly for poor households.

Keeping these in mind, the section (a) assesses the trends, fluctuations and seasonality in production and prices of rice (a less perishable item), potato (a moderately perishable item) and brinjal (a highly perishable item); (b) models volatility in production and prices of rice; and (c) estimates the impact of instability on food consumption.

(b) Market Analysis: this part revisits market performance–market structure, costs and margins across value-chains; market integration across domestic markets and with the cross-border economy.

This section examines vertical and spatial integration of markets for the above three food commodities. Each of these commodities differs in terms of their importance and role for food security and in the national diet.

Essentially, this component addresses itself to market efficiency and market integration of all three commodities for markets across Bangladesh. It also sheds light on rice market between Bangladesh and West Bengal.

(c) Market Institutions: This part explores the mechanisms of exchange, especially over longer distances, and the informal institutions and trading networks that underpin complex forms of trade.

This sub-theme carefully explores the relationships between different market actors and institutions in markets that underpin exchange. Econometric analysis such as co-integration, abstracts from these relationships to focus simply on prices in a bid to explain market performance. This is at best of partial relevance, as market behaviour cannot be analysed or understood without also referring to market actors and their motivations, their behaviour patterns, strategies and mechanisms used to ensure complex but credible, safe and rapid exchange.

1.1 Literature Review

This brief review is meant to locate the study within the broader literature in the Bangladesh context. In general, the literature on food-security in Bangladesh is extensive but the subject tended to be ignored in more recent years as food security concerns waned. The traditional focus on food self-sufficiency stimulated a large literature on the Green Revolution in the 1970s and 1980s (e.g. Alauddin and Tisdell 1991, Hossain 1988), concerned primarily with technology adoption constraints.

The focus then moved to reforms in agriculture and the food system, with a series of research onslaughts

against the PFDS, farmer subsidies for output and inputs, market and trade liberalisation (see Ahmed 2001, Chowdhury, Farid and Roy 2008, Dorosh and Murshid 2001). A corollary to this discourse was studies on market integration, largely limited to rice markets (Ravallion 1986, 1987, Dawson and Dey 2002).

Ravallion (1986) attempted to test for market integration using a radial market structure with a central market (Dhaka) and a group of five rural markets (Bogra, Dinajpur, Mymensingh, Rangpur and Sylhet). Each of these five hinterland markets had a history of being surplus in rice. Within his framework the central market dominates the price(s) of the rural market(s) in presence of market integration, and fails to persist in its absence. Using district level monthly coarse rice price data for the period July 1972—June 1975, which coincided with the famine of 1974, he tested for market integration. While his findings rejected segmented market structure, evidence on short run market integration was inconclusive. He attributed this apparent failure of market integration in the short run to trade impediments between the central market in Dhaka and the hinterland markets in the north and north-west rather than characterising it as non-competitive.

Ahmed and Bernard (1989) found higher spatial price spread during the aus season compared to the aman season but concluded that this did not lead to higher price arbitrage. The authors estimated the "Ravallion" model using monthly price data from 19 districts over 1981-1985 but was unable to reject the hypothesis of market integration, although they found that 25 per cent of the aus market was segmented.

Chowdhury (1992) tested the market integration hypothesis as well as the relevance of the "Ravallion

model'" using monthly data of coarse rice for 64 districts over July 1985-June 1991. Similar to the previous results, the hypothesis of integrated market could not be rejected. However, Chowdhury also found that the hitherto popular "Ravallion model" appeared less useful as Dhaka's status as the "central market" dictating prices began to wane in the face of competition from other emerging centres.

Goletti, Ahmed and Farid (1995) attempted to identify the proximate non-price determinants of rice market integration in Bangladesh. The study analysed monthly price data from 64 districts for the period July 1989 to June 1992. Market integration was found to be negatively related to distance, and positively with paved roads among other factors.

Das, Zohir and Baulch (1997) studied market integration using weekly wholesale prices of rice in 14 spatial markets during the first week of December 1987 to the last week of November 1996 and found that markets were well integrated. However, they could not find support for the law of one price (LOP). In contrast, Dawson and Dey (2002) found support for it when they revisited the Ravallion model using monthly data from January 1992 to December 1997 (the post-liberalisation period).

Rahman (1993) estimated marketing margins of several key agricultural products including rice, potato and brinjal. He found that marketing margins of different varieties of rice ranged between 14 and 19 per cent. Comparing this rate of return to that of trading capital with the financial rate of interest of 18 per cent in the formal market and 20-22 per cent in the informal market, and observing that a large share of the wholesale price is received by the farmers, he concluded

that the rice market is efficient and hence vertically integrated. In contrast, he found that marketing margins for potato are substantially higher at 39 per cent but that for brinjal is similar at 17 per cent. He thus concluded that the market for (fresh and frozen) potato were not efficient in view of the "abnormal" rate of return found. However, Rahman's (1993) reported marketing margins of potato are far higher than those reported in Moazzem and Fujita (2004), with the latter reporting margins that were as low as 1.2 per cent in a village in Comilla.

The main findings of these exercises were that rice markets in Bangladesh were highly competitive, and, therefore, there was little need for public interventions. While sometimes research findings, (e.g. Osmani and Quasem 1990, Crow and Murshid 1994) contradicted the mainstream views, these were noted but largely ignored. In 1999, IFPRI collaborated with BIDS to launch another series of studies on food policy, covering a large gamut of issues and hypotheses (del Ninno, Dorosh and Smith 2003, Shahabuddin and Dorosh 2002, Dorosh, del Ninno and Shahabuddin 2004, Murshid 1999, Murshid and Rashid 2001) including impact of floods and coping mechanisms, evaluation of remaining public interventions in the food sector, namely FFW, VGD and food for education (FFW) projects, as well as studies on macro-micro linkages, cross-border rice trade and price-wage relationships. An interesting finding from the cross-border study showed that private traders were able to respond very quickly to new opportunities—supporting the contention of competitive conditions and ease of entry into a new sector. The study on rice prices and wages clearly brought out the relatively sluggish response of wages to rice prices. At the household level, most studies

concentrated on vulnerable groups and the poor/ultra poor, with much of the energy devoted to measurement and estimation of poverty. However, there have been important contributions that have served to improve our understanding of chronic poverty, poverty dynamics, and factors affecting poverty (Sen and Hulme 2006). A corollary of these studies has been a steady stream of survey-based research on the link between micro-credit, infrastructure and poverty reduction (e.g. see Pitt, Khondaker, Chowdhury and Milimet 2003).

While household food consumption has been carefully observed and analysed, intra-household food distribution was much more difficult to study. Recent efforts, however, have served to address this gap (Razzaque, Khondker and Raihan 2007). As expected, significant intra-household variations were found, although the finding of a low, income-calorie elasticity somewhat confounds policy options.

It is striking, however, that there is rather scant literature on the problem of food output and price instability, or seasonality either at the macro-level or at the micro-level—the only exceptions are Murshid (1986, 1987) which looked at rice output instability and its impact at the macro and micro (household) level. This research, therefore, fills a major gap in the literature. In addition, the focus on household-level consumption fluctuations and the problem of coping/adjustment to price/production shocks contributes to our understanding of micro-level behaviour, especially of vulnerable groups. Some attention to this is found in the risk literature, although highly dated (e.g. Shahabuddin and Butterfield 1986, Shahabuddin, Mestelman and Feeny 1986).

This study covers the period 1973-2008 to examine the nature and trends in instability in outputs and prices for both rice and non-rice food in an effort to track trends and structural changes that have taken place in the underlying food economy. It also examines the nature of seasonality associated with the longer-run trends observed. A concern in this case is to test the hypothesis that the price-output relationship has changed fundamentally, and that due to a more open economy, prices have become much more aligned to cross-border and international prices. This also implies changing seasonal price patterns that are becoming increasingly de-linked from production seasonality, with very interesting implications for public policy.

The study also takes a close look at agricultural market structure and the underlying market institutions. Such market studies have become imperative in the context of the growing accusation of collusion and monopoly rents in the food market. This component of the research builds on earlier work by Crow and Murshid (1994) and Murshid (1997) to generate important insights into the fundamental strengths-weaknesses of real markets in Bangladesh.

1.2 Methodology and Data

The first sub-theme is explored using secondary data on prices, production and availability to assess year-to-year instability over time, using an appropriately specified ARIMA model. Seasonality is investigated using seasonal indices. The focus of this analysis is mainly on the instability of production, prices and consumption of rice. In addition, two other non-cereal food items—potato (less perishable) and brinjal (perishable)—were studied to gain an insight into the nature of instability experienced by these foods based on annual production

data for 36 years and monthly price data for 14 years. Data on production were collected from the Bangladesh Bureau of Statistics (BBS) and the Food Planning and Monitoring Unit (FPMU). Data on prices were collected from the Department of Agricultural Marketing (DAM).

Analysis was carried out in stages, starting with a descriptive analysis of trends and instability in production and prices, as well as the output-price relationship of rice. A similar descriptive analysis was carried out for the other two food crops. This was followed by an econometric analysis conducted to model seasonality and volatility in production and prices. A household consumption model was also estimated using data from the *Household Income and Expenditure Survey* (HIES) 2000 and 2005 to examine the impact on household consumption.

The second sub-theme conducts detailed investigations of marketing chains (costs-margins) and value chains, along with costs and returns for each segment of the chain. In addition, market integration studies have been conducted using co-integration and error-correction methods. The analysis revisits the question of spatial integration of markets after a span of many years (for rice), and for the first time for the two other commodities selected. Both primary and secondary data were used for the exercises.

The third sub-theme examines market institutions that are essential for proper functioning of competitive markets, that is, those that enable smooth, unfettered transactions to take place in an atmosphere of safety, security and trust, especially of complex transactions over time and distance, domestically and internationally. Institutions related to trade finance, dispute resolution and arbitration are very important. In particular, it is

critical to understand the manner in which different actors/traders establish binding contracts. A new institutional framework approach was adopted to examine transaction relations (formal and informal) information asymmetries, relative bargaining power, and enforcement mechanisms.

The impact at the macro level (inflation) and micro level (household income, wages, poverty) was assessed in Chapter 2 using HIES data for two periods (2000 and 2005). However, the sharp volatility in the food market occurred well after 2005, and thus is likely to have been missed. An attempt is made in the last chapter to combine evidence garnered from purposive focus group discussions (FGDs) and primary data collected from poor and non-poor households in an advanced and a backward area of Bangladesh. This exercise was conducted on a small scale, for illustrative purposes, to help focus attention on the nature of micro level effects and adjustment processes that are employed to deal with a situation of high market volatility.

CHAPTER 2

INSTABILITY IN PRODUCTION, PRICES AND IMPACT ON CONSUMPTION

2.1 Trends and Fluctuations in Rice Production

Area under Rice Cultivation

Bangladesh is a densely populated country that faces acute pressure on land for many conflicting uses e.g. for agriculture, industry, housing and physical infrastructure. *Naturally, availability of land for crop agriculture is expected to be squeezed over the years unless new lands are reclaimed, e.g. from the sea – not a very likely prospect. Thus, to feed the growing population, food production must be increased, especially of staples. Data show that area under rice cultivation has increased only marginally (by only 0.30 per cent annually) over the period 1972/73-2007/08. However, there has been a shift towards production of high yielding* varieties, away from local varieties (Table 2.1).

Trends in Production and Yield of Rice

Total rice production has increased at a rate of about 3 per cent per year over the period 1972/73-2007/08, of which boro registered the highest growth (over 6.0 per cent per year) (Table 2.1). Productivity of all varieties (as reflected in per acre production of rice) has also increased substantially over the same period (Table 2.2). Graphs 2.1 through 2.4 represent trends in rice production and yield per acre by both seasons of rice (i.e., aus, aman, and boro) and technology used (i.e., local vis-á-vis high yielding). A three-year moving average was used to remove the irregular fluctuations from data before fitting the trend line. As the graphs show, upward trends are observed for aman, boro, “high

yielding" and "total rice production" as against the performance of aus and "local", which show a declining trend. For yield per acre, however, a secular upward trend is observed for all crops.

The entire period has been divided into three sub-periods[1] based on different policy regimes and a similar trend analysis has been carried out for each of them separately as shown in Graph 2.5. Clearly, rice production has increased at a relatively faster rate in the later periods.

TABLE 2.1

AREA UNDER RICE CULTIVATION AND TRENDS IN RICE PRODUCTION

Variety	Year						Growth Rate (%) (1972/73-2007/08)	
	1972-80		1980-95		1995-08			
	Area	Production	Area	Production	Area	Production	Area	Production
Aman	14210	6799	14447	8349	13435	9706	-0.29	1.53
Aus	7812	2922	6267	2671	3241	1737	-2.69	-1.14
Boro	2618	2134	4929	4928	8579	10849	4.31	6.15
Local	21099	8484	16659	7485	9535	4880	-3.10	-1.60
HYV	3541	3371	8985	8464	15720	17412	5.90	6.70
Total	24640	11855	25643	15949	25255	22292	0.30	3.01

Source: BBS: *Statistical Yearbook of Bangladesh* (various years).

Note: Area is in 000 acres and production is in 000 metric tons.

TABLE 2.2

TRENDS IN YIELD OF RICE

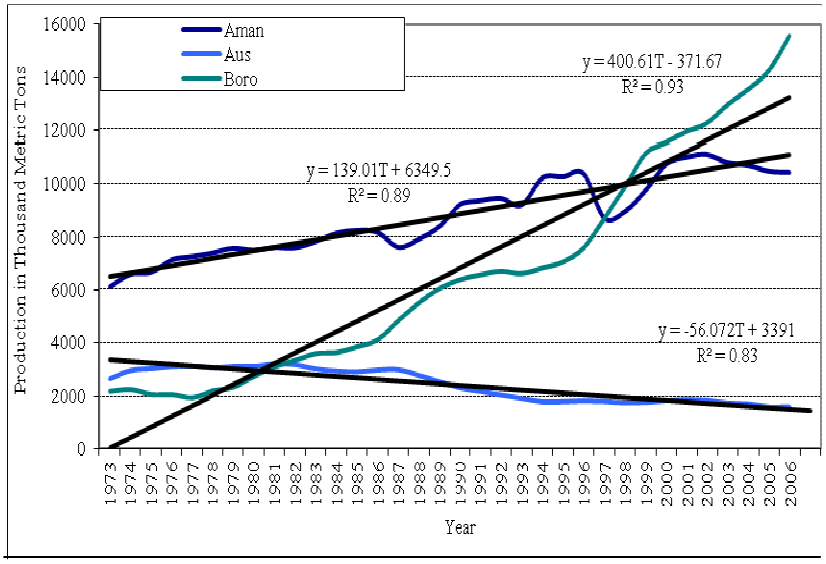
(yields are in metric tons per acre)

Variety	Period			Growth Rate (%) (1972/73-2007/08)
	1972-80	1980-95	1995-08	
Aman	0.4780	0.5794	0.7584	1.89
Aus	0.3733	0.4303	0.5683	2.10
Boro	0.8146	0.9936	1.2800	1.70
Local	0.4016	0.4533	0.5258	1.60
HYV	0.9540	0.9374	1.1172	0.70
Total	0.4806	0.6232	0.8941	1.70

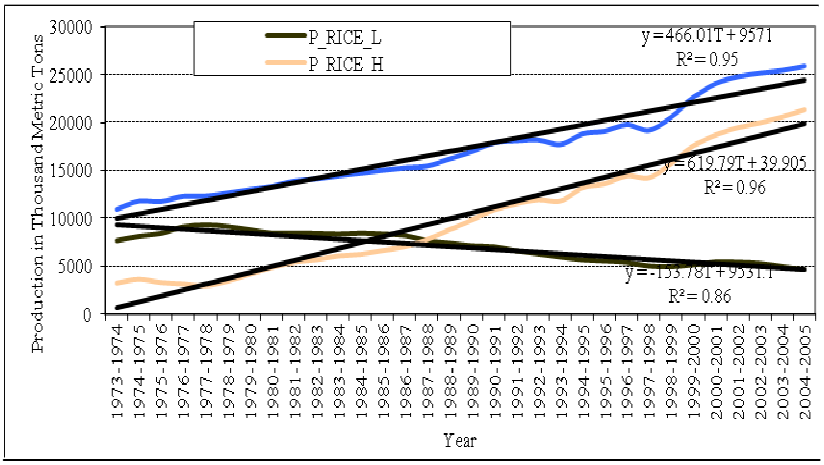
Source: BBS: *Statistical Yearbook of Bangladesh* (various years).

[1] Period 1: 1972/73-1979/80; Period 2: 1980/81-1994/95; and Period 3: 1995/96-2007/08.

Graph 2.1: Trends in Rice Production by Season

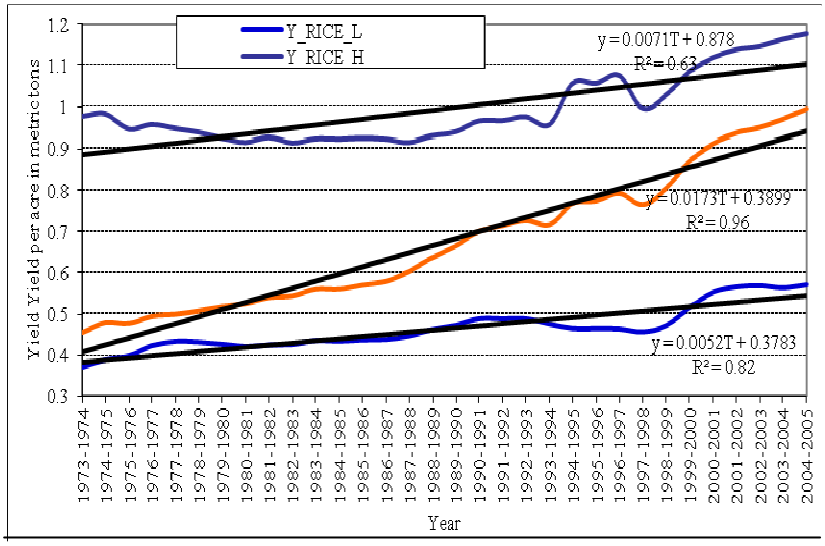


Graph 2.2: Trends in Rice Production by Technology



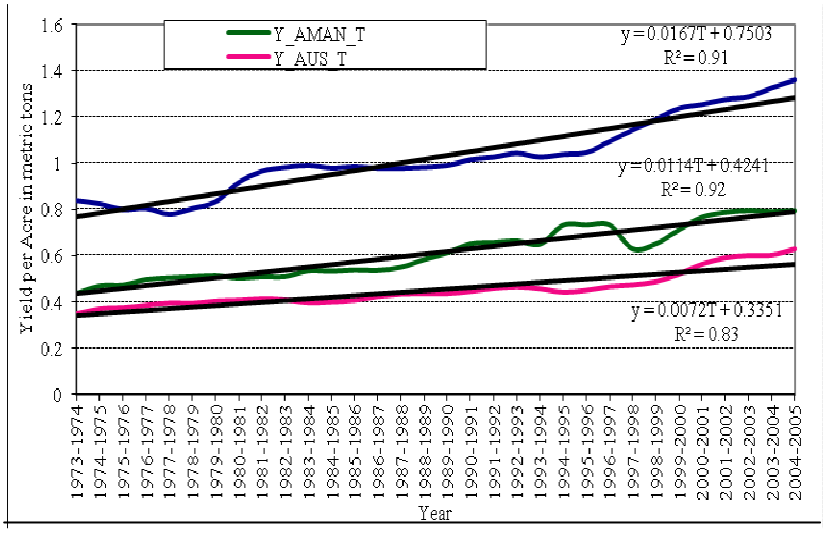
Note: "P" for production, "L" for local variety, "H" for high yielding variety, and "T" for total.

Graph 2.3: Trends in Yield per acre of Rice by Technology



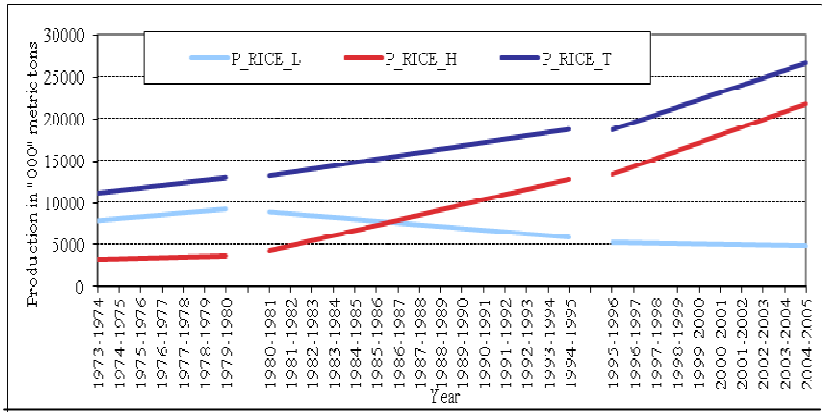
Note: "Y" for yield, "L'" for local variety, "H" for high yielding variety, and "T" for total.

Graph 2.4: Trends in Yield per Acre of Rice by Season



Note: "Y" for yield, "L" for local variety, "H" for high yielding variety, and "T" for total.

Graph 2.5: Trends in Rice Production by Three Sub-Periods



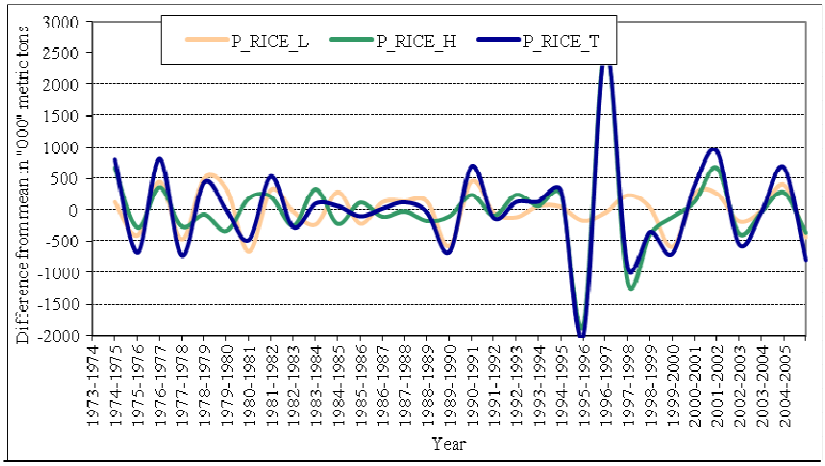
Note: "P" stands for production, "L" for local variety, "H" for high yielding variety, and "T" for total.

Fluctuations and Seasonality in Rice Production

Although a secular upward trend is observed for rice production in Bangladesh, there is no reason to believe that it has gone through without any fluctuation. In order to assess the pattern of fluctuations in production between years, data were de-trended[2] using the linear trend line before looking into the inter-year fluctuation. Graph 2.6 represents the fluctuations in rice production between the years that shows more fluctuation during the 1970s, less fluctuation during the period beginning from the early 1980s to mid-1990s, and again more pronounced fluctuations during the period afterwards. Seasonality in production has also been analysed using aus, aman and boro as seasons. Results show a significant seasonality in production of rice in Bangladesh, which has bearing on the supply and availability of rice in the domestic market (Graph 2.7).

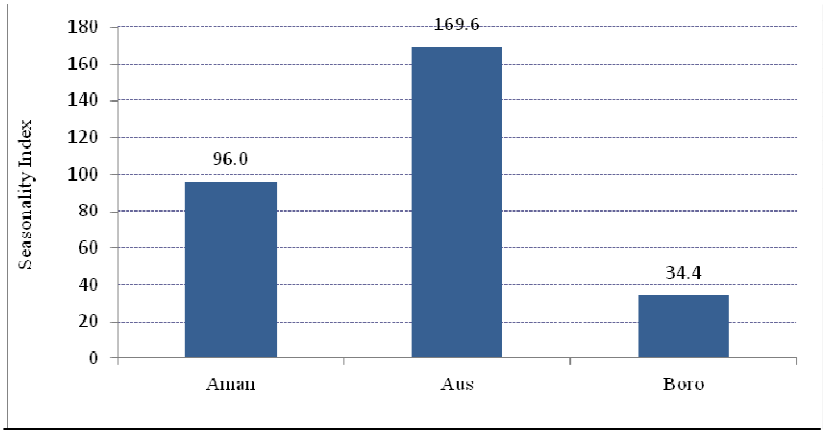
[2] De-trending is a statistical technique of removing trend component from the time-series.

Graph 2.6: Fluctuation in Rice Production



Note: "P" stands for production, "L" for local variety, "H" for high yielding variety, and "T" for total.

Graph 2.7: Seasonality in Rice Production



Note: The values in the vertical axis represent the seasonality index (for the period 1972/73-2007/08) where higher value indicates higher level of seasonality and vice versa.

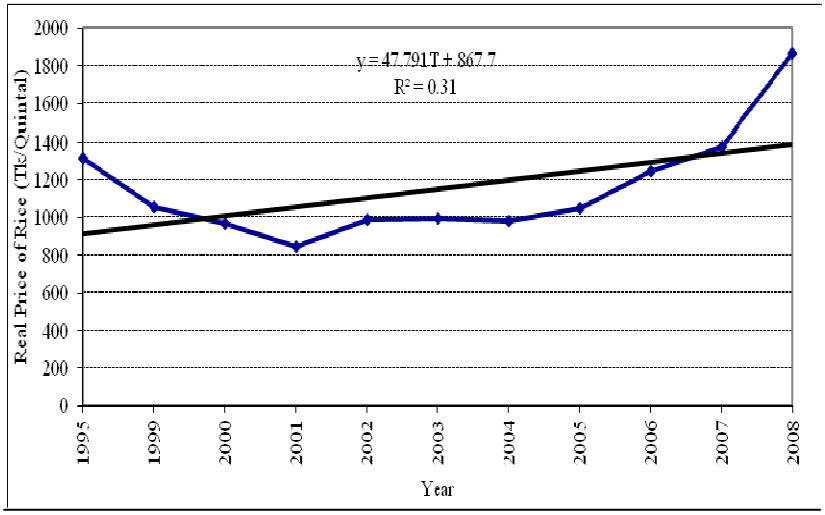
2.2 Trends and Seasonality in Rice Prices

Trends and Fluctuations in Rice Prices

Price volatility of rice has been the major food security issue in recent years. Rice price has gone up

significantly in 2007 and 2008, both locally and internationally, although a downward trend was observed in more recent years. For analysing the trends in rice prices, both nominal and real prices[3] have been considered. A three-year moving average has also been used to eliminate the irregular fluctuations in prices. Results show a clear upward trend in rice price during 1995 till 2007 with noticeable fluctuation between the years as reflected in Graphs 2.8 through 2.10. It may be pointed out that while both nominal and real price have shown a similar upward trend, inter-year fluctuations are much more pronounced for real prices than for nominal prices.[4]

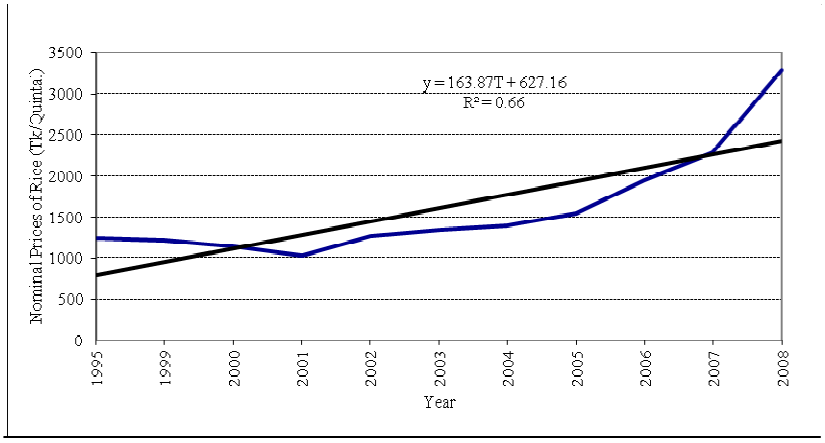
Graph 2.8: Trends in Real Prices of Rice



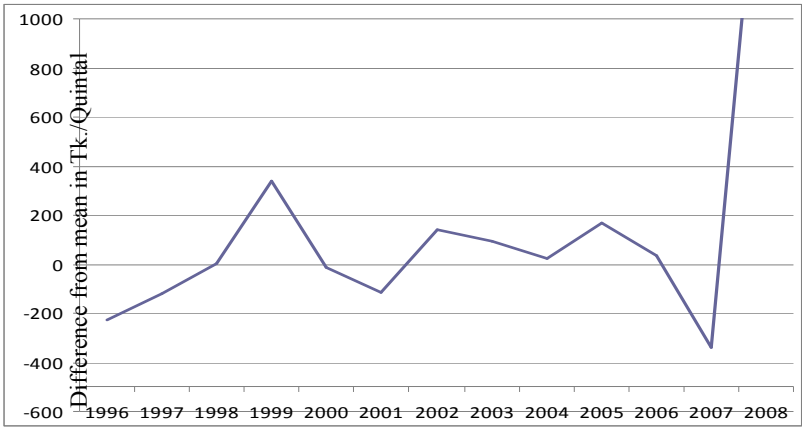
[3] Real prices of rice have been obtained by deflating the nominal price by the non-food price index.

[4] The period covered corresponds to the post-reforms period in Bangladesh agriculture that brought about significant gains in terms of production and stable prices. It is important to examine recent trends in agricultural prices as it is widely believed to have become much more uncertain in recent years.

Graph 2.9: Trends in Nominal Prices of Rice



Graph 2.10: Fluctuations in Nominal Rice Prices



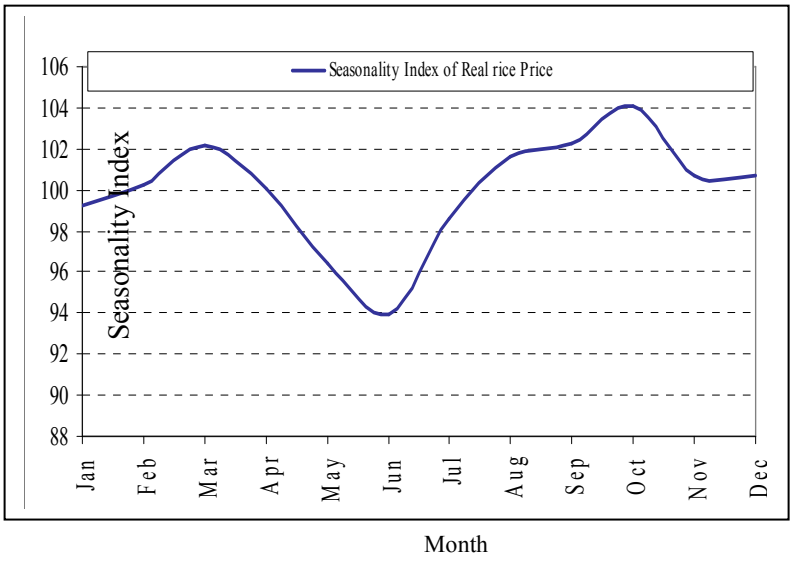
Seasonality in Rice Prices

There are several ways to conduct seasonality analysis. Perhaps the simplest is to produce a graph with the factor being studied (i.e., price in this case) on the vertical axis and time (i.e., months in this case) on the horizontal axis. This is most appropriate for periods of relative stability in market conditions. Another technique is to construct a "seasonality index" with the

denominator specified as the average number of months in the period considered. The price at each period is expressed as a percentage of the seasonal average which produces a value equal to, greater than, or less than 100. This methodology has been used in this study. It may be noted that before constructing the seasonality index, both irregular fluctuations and trend were removed using moving averages[5] and by fitting linear trend lines. It may also be noted that the seasonality index was constructed using real prices.

Rice price seasonality is presented in Graph 2.11. The graph shows that there exists noticeable seasonality in rice prices with February/March and September/ October as peak and May/June as the trough. This corroborates with the seasonality patterns observed earlier.

Graph 2.11: Seasonality in Real Rice Prices

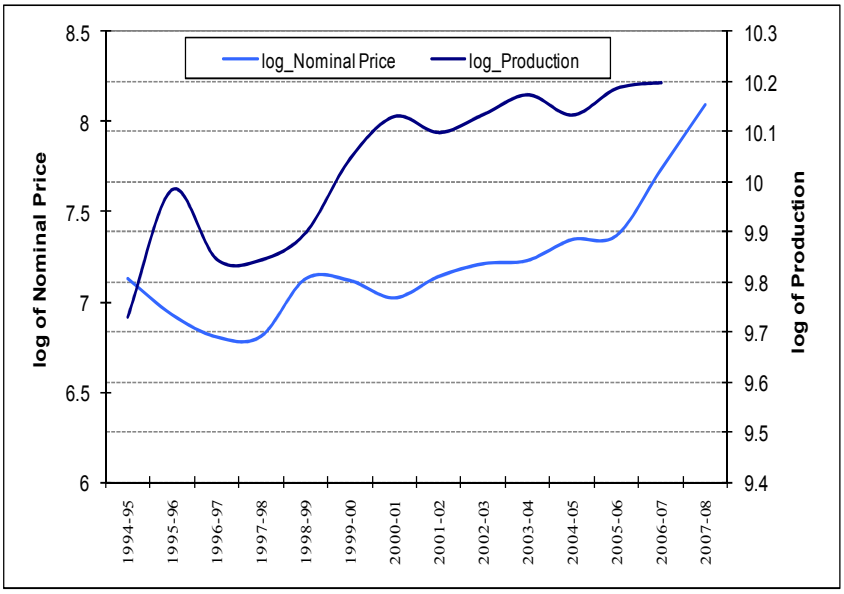


[5]Please note that while taking moving average, both the first and the last observations are lost. That is why the number of years mentioned in the graph will be one year less from both ends.

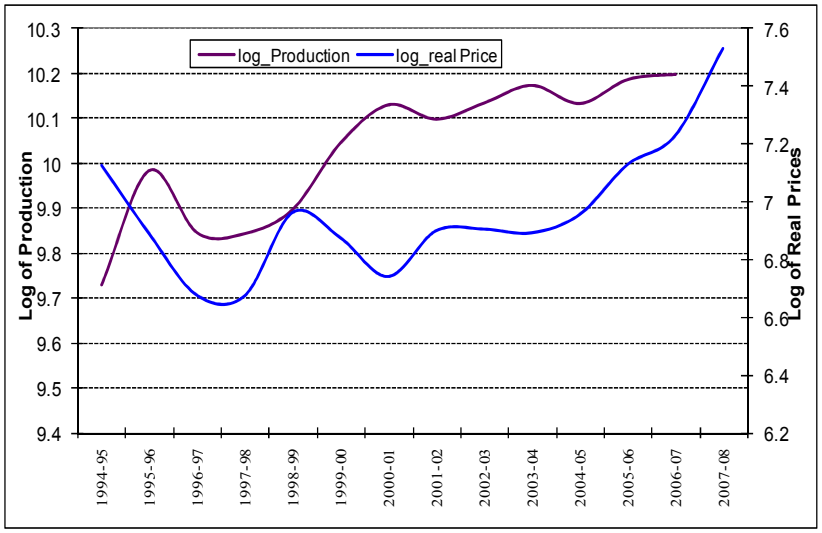
2.3 Instability in Production-Price Relationship

It has been noted that rice production has increased over the years but this was associated with significant fluctuations over time as well as intra-year seasonality. It would, therefore, be interesting to see whether there is any systematic relationship between the movement of production and prices of rice. For the purpose, the time period chosen was 1994/95-2007/08 for which both production and price data are available. Separate comparisons were made using both nominal and real prices. Graphs 2.12 through 2.14 illustrate this. The results show that there is no systematic relationship between domestic production and prices of rice in the local markets.

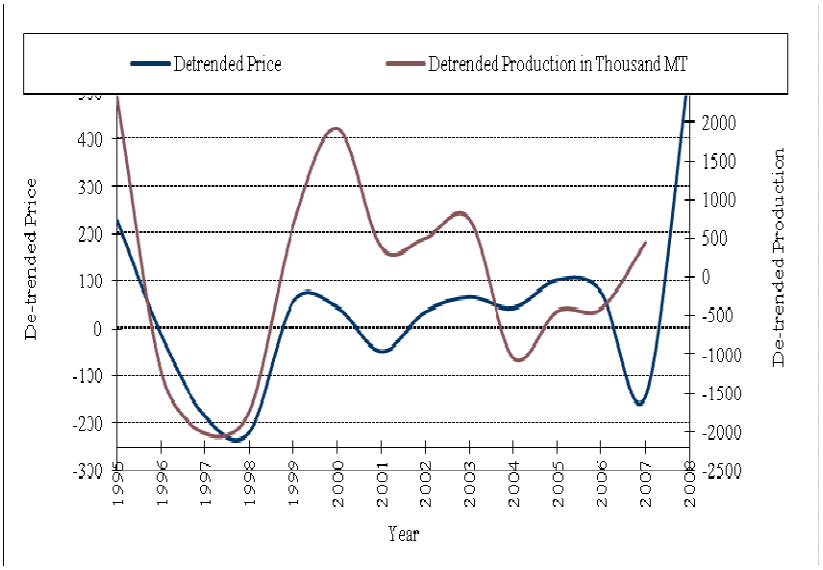
Graph 2.12: Production and Nominal Price Movements



Graph 2.13: Production and Real Price Movements



Graph 2.14: Production and Price Fluctuation



In order to look into the relationship within a multivariate framework, linear and logarithmic regressions were estimated with price as the dependent variable and production, import, public food grain distribution system, international price and two seasonal dummies (one for *aus* and the other for *aman*) as independent variables. The following functional forms were specified for estimation purposes:

$$P=a+b_1Y+b_2M+b_3F+b_4I+b_5A+b_6N+\varepsilon \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (2.1)$$

and

$$LnP = a+b1LnY+b2LnM+b3LnF+b4LnI+b_5A+b_6N+\varepsilon \ldots \quad (2.2)$$

where, P=local price of rice; Y=domestic production of rice; M=import of rice; F=PFDS off take; I=international price of rice; A=seasonal dummy for *aus*; N=seasonal dummy for *aman*; and ε = disturbance term.

Regression results in Table 2.3 also confirm lack of statistical significance between prices and production of rice.[6]

TABLE 2.3

REGRESSION RESULTS WITH PRICE AS THE DEPENDENT VARIABLE

Variables	Linear		Log-linear	
	Coefficients	Sig. Level	Coefficients	Sig. Level
Constant	768.90	0.07	5.644	0.05
Production	0.014	0.64	-0.029	0.92
Imports	0.018	0.75	0.0003	0.99
PFDS off take	0.326	0.12	0.279	0.04
International Price	-0.115	0.88	-0.025	0.88
Dummy for Aus	156.15	0.66	-0.087	0.88
Dummy for Aman	138.67	0.27	7.575	0.46
Adjusted R^2	0.45	-	0.48	-

[6] One may argue about the usefulness of these regressions where most of the explanatory variables are either not statistically significant or with wrong signs. However, the main point to confirm that there is no systematic relationship between the domestic production and local price of rice which is evident from these regression results.

This points to the fact that rice price is not solely dependent on domestic production, but on other factors as well. Some of these factors might include seasonality in production, stock behaviour and other unobservable factors. It may be noted that PFDS offtake has a significant impact on prices but has the wrong sign, while production has the correct sign but is not statistically significant in the log-linear form. Not too much can be made out of this regression analysis. A much more rigorous price analysis is required to arrive at a more robust conclusion. This, however, does raise a clear hypothesis for future verification: domestic prices may be increasingly subjected to the influence of non-domestic factors. However, which external factors are likely to be important, how external events translate into domestic price shocks (e.g. through imports or speculation) are matters that require investigation. The wrong sign of the PFDS variable is also of concern – does this mean that in fact PFDS has no price stabilisation impact or is it the case that specification is incorrect, especially of price? It would probably be better to redefine the price variable in terms of pre- and post-harvest prices and relate this to *aman* and *boro* production, imports and off-takes through the PFDS and safety-net programmes. Further, the international price variable should probably be redefined in terms of ex-Indian or ex-Kolkata prices instead of the ex-Bangkok price that was used.

Modelling Volatility

In the conventional econometric models, the variance of the disturbance term is assumed to be constant. However, many economic time series exhibit periods of unusually large volatility, followed by periods of relative tranquillity. In such circumstances, the assumption of a constant variance (i.e., homoskedasticity) is in

appropriate, and it is, therefore, important to model the variance of a series. The ARCH[7] and the GARCH[8] models have become very popular in this respect in that they enable the econometrician to estimate the variance of a series at a particular point in time.

Engle (1982) proposed the ARCH model which is specified as follows:

$$R_t = u_{t-1} + e_t \quad (2.3)$$

$$e_t \sim N(0, \sigma_t^2)$$

$$\sigma_t^2 = \alpha_0 + \sum \alpha_i e^2_{t-i} \ (i=1, 2, ..., q)$$

Where, R_t is the variable of interest, u_{t-1} is the conditional mean, and e_t is the error term of the mean equation, which is serially uncorrelated with mean zero. But the conditional variance of e_t equals σ_t^2, which is a function of q past squared residuals. For the ARCH model to be well defined, the parameters of conditional variance equation should satisfy the following: $\alpha_0 > 0$ and $\alpha_i \geq 0$.

Bollerslev (1986) extended the ARCH model in which volatility at time t is not only affected by q past squared residuals, but also by p lags of past estimated volatility, which is known as GARCH model. The specification of GARCH (p, q) is given by:

$$R_t = u_{t-1} + e_t \quad (2.4)$$

$$e_t \sim N(0, \sigma_t^2)$$

$$\sigma_t^2 = \alpha_0 + \sum \alpha_i e^2_{t-i} + \sum \beta_j \sigma^2_{t-j} \ (i = 1, 2, ..., q; j = 1, 2, ..., p)$$

The parameter α_i capture the ARCH effect, whereas β_j capture the GARCH effect.

---

[7]Autoregressive Conditional Heteroskedastic model.
[8]Generalized Autoregressive Conditional Heteroskedastic model.

The volatility in production and prices in rice in Bangladesh is tested employing these ARCH/GARCH models. Data used for estimating these models is in terms of seasonal (i.e., aman, aus and boro) data for 36 years (i.e., 108 observations in total) for production and monthly price data for 14 years for prices. In order to select the appropriate lags in model estimation for both production and prices, autocorrelation function (ACF) and partial autocorrelation function (PACF) are carried out, which indicates up to lag 3 for production and lag 1 for prices as appropriate lags for the models (see Graph 2.14 in this respect). Estimated results are presented in Tables 2.4 and 2.5 respectively.

TABLE 2.4

VOLATILITY IN RICE PRODUCTION: ESTIMATION OF ARCH/GARCH (3, 3) MODELS

Variables		Coefficients	Standard Errors	Z-Statistic	P-Value
Constant		2649.65	110.5048	23.98	0.0000
ARCH					
	Lag-1	0.0116	0.0024	4.67	0.0000
	Lag-2	0.9028	....	....	....
	Lag -3	4.7904	....	....	....
GARCH					
	Lag-1	-2.7823	0.0077	-360.62	0.0000
	Lag-2	-6.6806	0.0109	-609.20	0.0000
	Lag-3	4.8201	....	....	....

TABLE 2.5

VOLATILITY IN RICE PRICE: ESTIMATION OF ARCH/GARCH (1, 1) MODELS

Variables	Coefficients	Standard Errors	Z-Statistic	P-Value
Constant	1239.27	74.9668	16.53	0.0000
ARCH (1)	0.8764	0.2577	3.40	0.0010
GARCH (1)	-0.0162	0.0335	-0.48	0.6280

Results show significant ARCH and GARCH effect for production and only ARCH effect for prices. This implies

that there exists significant instability in both production and prices of rice. However, the instability in prices is only affected by past squared residuals, whereas instability in production is affected by both past residuals and its volatility. This finding may be interpreted as showing that the error term is non-random and large, implying significant volatility in the series that is not due to chance, especially for production but also for prices. The economic implication of these findings is that these variables cannot be treated as random events (and therefore unpredictable) in nature. This also raises the question of the nature of non-randomness that is involved along with the underlying factors contributing to it - a subject that requires further investigation.

2.4 Trends and Fluctuations in the Production and Prices of Potato and Brinjal

As mentioned earlier, similar analyses (except econometric analysis) were also been carried out for potato and brinjal. The data reveals a slow increase in production of both potato and brinjal during the period beginning from the early 1970s up to the mid 1990s and a sharp increase thereafter (Table 2.8 and Graphs 2.15 and 2.16). In particular, production of both potato and brinjal experienced sharp increases during 1996/97 to 2000/01, tapering off slowly thereafter. This may have happened because of increased diversification in agriculture that encouraged more vegetable cultivation in the country. Both potato and brinjal production also experienced significant fluctuations which has tended to increase over time (Graphs 2.17 and 2.18).

Price of potato and brinjal also went up during the period 1995-2008. Like production, prices rose more rapidly in recent years compared to the previous years

(Table 2.9 and Graphs 2.19 and 2.20). There also exists significant price seasonality in both commodities (Graphs 2.21 and 2.22) with these being generally much more pronounced compared to rice prices (Graph 2.23).

From a food security perspective, it is important to investigate whether the seasonalities observed in rice prices and those of potato and brinjal tend to offset or reinforce each other. Partial correlation exercises of rice price seasonality with that of potato and brinjal demonstrate that while potato price seasonality offsets rice price seasonality (i.e., negative correlation between the two), brinjal price seasonality accentuates it (Tables 2.6 and 2.7). As potato has emerged as an important food item in Bangladesh, this can be seen as a positive finding for food policy planners.

TABLE 2.6

CORRELATION MATRIX: SEASONALITY OF RICE AND POTATO PRICES

	Potato	Rice
Potato	1.00	-0.293
Sig. Level	0.00	0.383
Rice	-0.293	1.00
Sig. Level	0.383	0.00

TABLE 2.7

CORRELATION MATRIX: SEASONALITY OF RICE AND BRINJAL PRICES

	Brinjal	Rice
Brinjal	1.00	0.722
Sig. Level	0.00	0.012
Rice	0.722	1.00
Sig. Level	0.012	0.00

Source: Authors' estimates based on DAM data.

TABLE 2.8
TRENDS IN AVERAGE PRODUCTION OF POTATO AND BRINJAL

('000' metric tons)

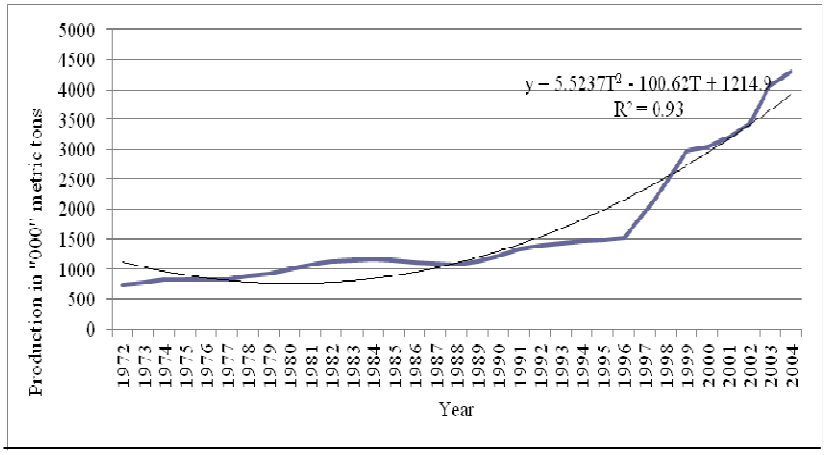
	Year			Annual Growth Rate (percentage)
	1972-80	1980-95	1995-06	
Potato	824	1192	2979	5.35
Brinjal	-	177	308	3.19

TABLE 2.9
TRENDS IN AVERAGE WHOLESALE PRICE (TK./QUINTAL) OF POTATO AND BRINJAL

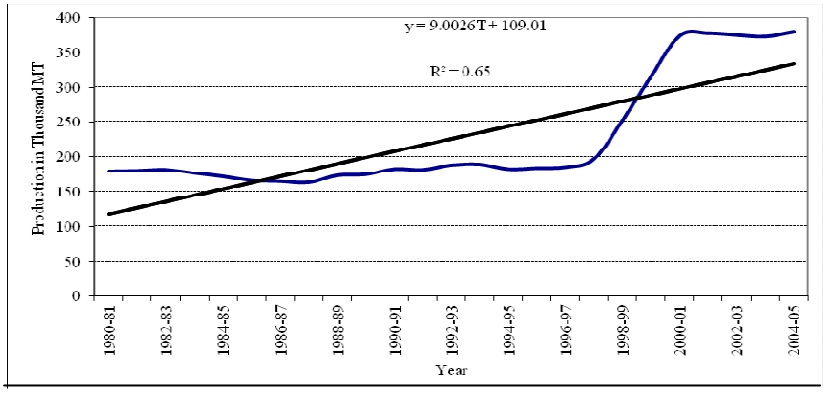
Food Items	Year					Growth rate (percentage)
	1995-96	1997-98	2000-01	2003-04	2006-07	
Potato (Holland White)	647	625	610	872	1598	1.98
Brinjal (High Quality)	807	953	1052	1053	1352	1.08

Source: Authors' estimates based on DAM data.

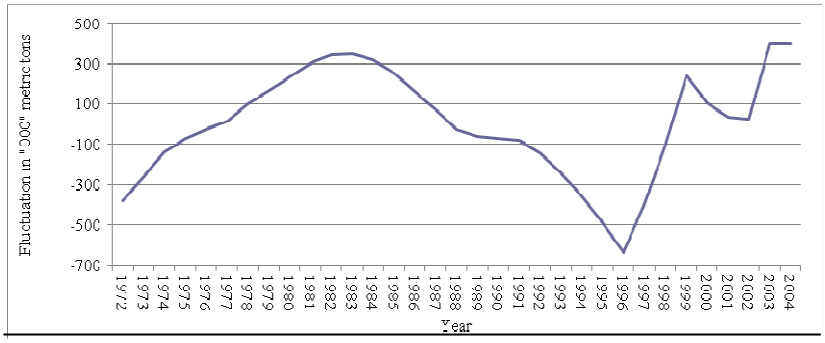
Graph 2.15: Trends in Potato Production



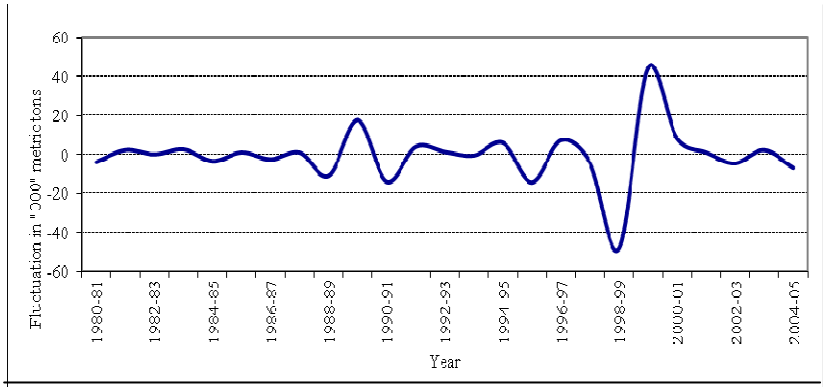
Graph 2.16: Trends in Brinjal Production



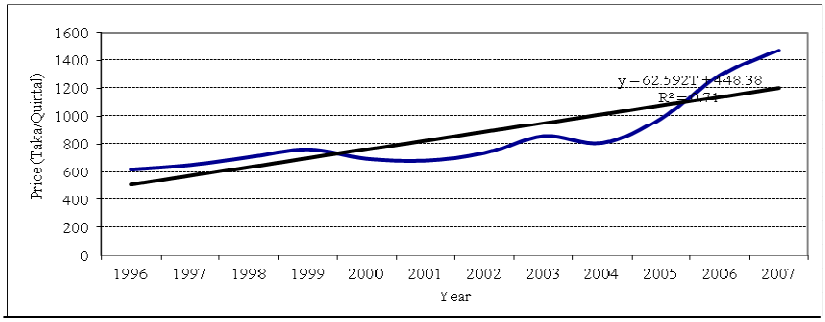
Graph 2.17: Fluctuations in Potato Production



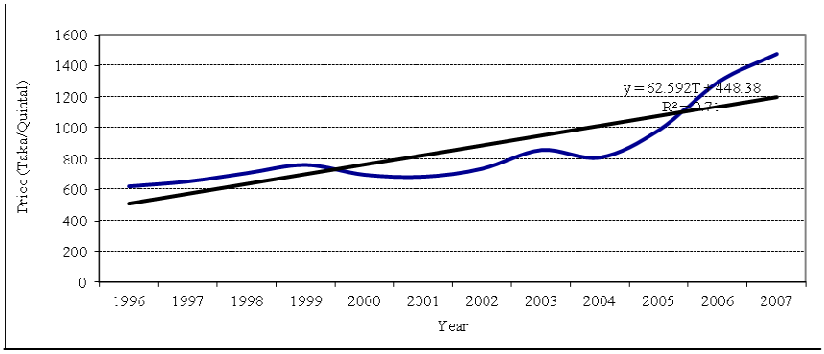
Graph 2.18: Fluctuations in Brinjal Production



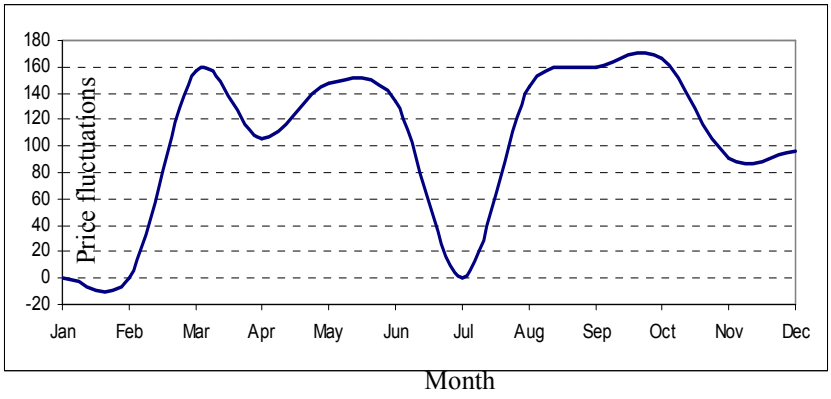
Graph 2.19: Trends in Potato Price



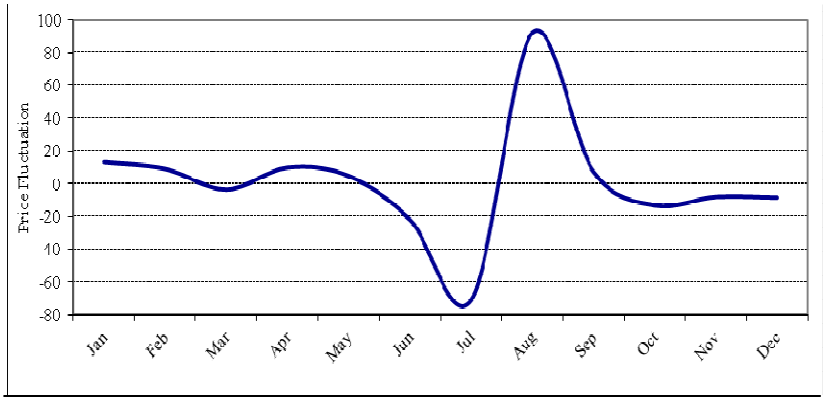
Graph 2.20: Trends in Brinjal Price



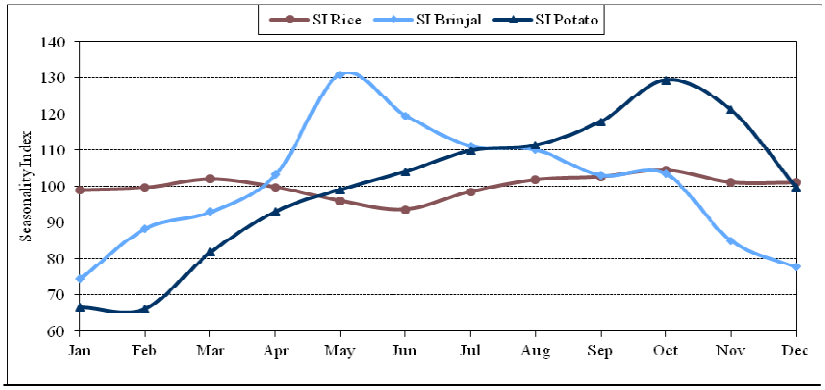
Graph 2.21: Seasonal Fluctuations in Potato Prices



Graph 2.22: Seasonal Fluctuation in Brinjal Prices



Graph 2.23: Seasonality Comparisons: Prices of Rice, Potato and Brinjal



Note: SI represents seasonality index.

Fluctuations in Availability and Consumption of Rice

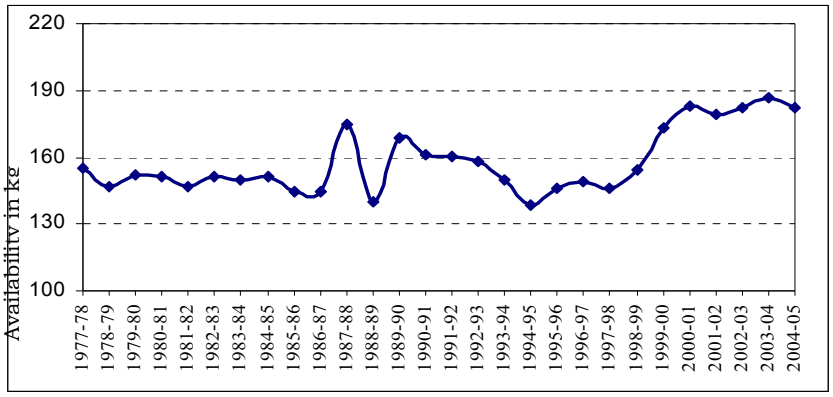
So far, the trends and fluctuations in production and prices of rice, potato and brinjal have been analysed at the aggregate level. Production does not necessarily indicate availability and ensure access at the individual/household level. An attempt has been made in this sub-section to assess if there is any fluctuation in availability of rice at the macro level and access at the micro (household) level.

Data on per capita availability of rice show noticeable inter-year variation. However, per capita availability over the last decade has increased significantly compared to the previous two decades (Graph 2.24).

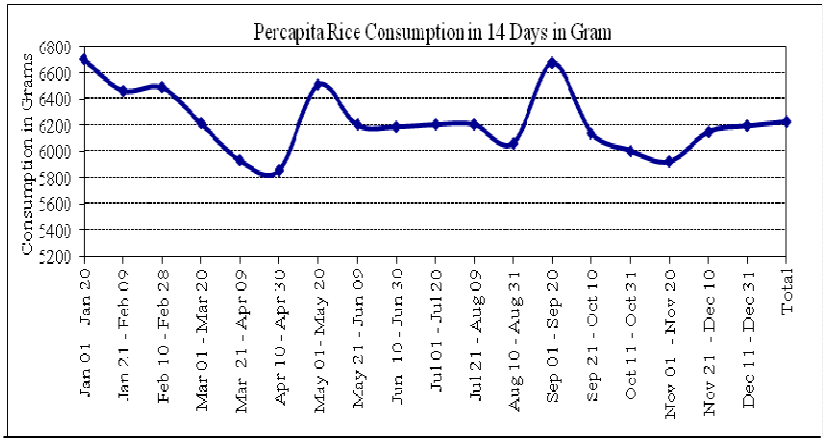
Fluctuations in per capita rice consumption have also been analysed using the HIES (2005) data. Although HIES is a cross-section survey, data were collected during a full calendar year at three-week intervals. Assuming that the households interviewed during each 3-week period adequately represent the total households interviewed under HIES, we can establish a time trend for per capita rice consumption over 18 such consecutive time periods (beginning from 01 January to 20 January) for the year 2005.

The relevant results show significant fluctuation in rice consumption between months of the year with rice consumption reaching a trough in March/April and a peak in January and May (Graph 2.25). If this is compared with rice price seasonality observed earlier, one may observe that this is exactly what one would expect: *price fluctuations have a direct bearing on food consumption.*

Graph 2.24: Per Capita Annual Availability of Rice



Graph 2.25: Fluctuations in Per Capita Rice Consumption



2.5 Impact of Instability in Income and Prices on Food Consumption

In order to examine the impact of instability on income (due to instability in production or employment or other reasons) and price of rice on household food consumption, a logarithmic consumption function was estimated with per capita consumption of rice as the dependent variable and a range of other variables as explanatory variables, including household income classified into two categories (regular and seasonal[9]), total operated land and the price of rice (as reflected by unit cost).

[9] Regular incomes are those that are stable, relatively permanent in nature and earned on a regular basis by the household members. Salaried income, income from businesses and professional activities are the examples of regular income. Seasonal incomes are those that are temporary in nature, unstable, depend on weather and season and, hence, earned irregularly by the household members. Agricultural wage is the best example of seasonal income in the context of Bangladesh. Data on income earned from different sources was collected from HIES 2000 and 2005 and classified into two categories mentioned above.

Specification of the model is presented below:

$$\ln C = \alpha + \beta_1 \ln RI + \beta_2 \ln SI + \beta_3 \ln PR + \beta_4 \ln OL + \varepsilon \quad (2.5)$$

Where, C = per capita consumption

RI = regular income

SI = seasonal income

PR = price of rice

OL = total operated land

ε = disturbance term

Pooled cross-section and time-series data of HIES 2000 and 2005 were used to estimate the model applying ordinary least squares method. The results reported in Table 2.10 indicate significant adverse effects of instability on household food consumption: Per capita irregular income had a significant and positive impact on household food consumption. Regular income had the correct sign but was not found to be statistically significant. Operated land and prices were associated with the correct sign and were also statistically significant (at higher levels of probability).

TABLE 2.10

ESTIMATES OF PER CAPITA CONSUMPTION OF RICE

Selected Explanatory Variable	Estimated Co-efficient	t-statistic	Significance level
Per capita regular income	0.015	0.945	0.344
Per capita irregular/ seasonal income	0.196	12.33	0.000
Total operated land	0.075	4.86	0.000
Prices of rice	-0.116	-7.84	0.000
Adjusted R^2	0.06	-	-
F-value	77.15	-	0.000

Source: Authors' estimates based on HIES data.

The low power of the above regression is not unusual in cross-section analysis. The F statistic shows that the overall equation is significant. Prices, irregular income, and operated land were found to be significant and with the expected signs. Regular income failed to reveal any relationship.

2.6 Summary and Conclusions

Rice production has increased at a rate of about 3 per cent per year over the period 1972/73-2007/08, of which boro registered the highest growth (over 6.0 per cent per year). Productivity of all rice varieties (as reflected in per acre yields) has also increased substantially over the same period. It is also observed that rice production increased at a relatively faster rate in the later periods.

However, the increase in production over the years was not smooth but was associated with significant fluctuations over time. It was also observed that the 1970s experienced larger fluctuations compared to the succeeding decades, rising once again after the mid-1990s. Seasonality analysis reveals the existence of significant seasonal movements in rice production.

Rice price has also gone up significantly over the past years, and, in particular, during 2007 and 2008 when both local and international prices shot up. The data show a clear upward trend in the rice price during the period 1995-2008, with noticeable fluctuations across years. There also exists noticeable price seasonality of rice price corresponding to the production seasonalities observed earlier (with peaks in February/March and September/October and a trough in May/June).

An attempt was made to examine the domestic production-price relationship, which tended to suggest

that this was weak. A more thorough investigation of these issues is warranted, using preferably the marketed surplus (rather than production) to represent the supply side. Paucity of time-series data on marketed surplus makes this difficult.

Regarding other food items under investigation namely potato and brinjal, results show a slow but steady increase in production during the period beginning from the early 1970s up to mid-1990s, and a sharp increase afterwards. Production of both potato and brinjal also reveals significant fluctuations over time. It is also observed that fluctuations are greater in more recent years compared to earlier periods. Prices of potato and brinjal also went up during the period 1995-2008.

Partial correlation exercises of rice price seasonality with that of potato and brinjal demonstrate that while potato price seasonality offsets rice seasonality (i.e., negative correlation between the two), brinjal price seasonality further accentuates it. It was also observed that instability in prices has a direct bearing on food consumption so that maintaining stability in food prices remains an important food policy objective.

CHAPTER 3

MARKET INTEGRATION

3.1 Introduction

Market integration is a necessary but not a sufficient condition for food security. When markets work, the automatic adjustment process performs the complex task of coordinating supply and demand with minimum fuss, resulting in the efficient allocation of resources. When markets fail, participants with inside information and economic power are able to exploit both producers and consumers to the special detriment of the poor at each end (Timmer, Falcon and Pearson 1983). Market integration per se has two dimensions: vertical (over time) and horizontal (across space). A key food policy objective is to ensure that markets are integrated in both senses.

When markets are vertically integrated, resources are efficiently utilised and no agent in the supply chain can earn a supra normal return on their investment. In contrast, spatially integrated markets eliminate the possibility of a food deficit within a particular geographic location when there is no deficit at the national level, thereby tending to equalise prices across regions after accounting for transport and handling costs. This chapter explores spatial market integration for three food commodities, namely rice, potato and brinjal.

3.2 Vertical Integration

In order to explore the extent of vertical integration, this section examines (a) marketing channels and participants, and (b) costs, margins and profits

associated with marketing, with reference to the urban markets of Bogra, Dhaka and Noakhali for the three food commodities. Initially, market agents were interviewed in the urban markets to identify supply chains and intermediaries. Subsequently, follow-up visits were made to farmers to identify costs, margins and profits using primary data. The general method used for computation of margins was as follows:

$$GMM = \sum_{k} P_e - P_b)_k \qquad (3.1)$$

In each kth market segment

$$P_e - P_b = \sum_{i} C_{i\ s,\ f} + \mu_{s,\ f}$$

$$NMM = \mu_{s,\ f} = GMM - \sum_{i} C_{i\ s,\ f} \qquad (3.2)$$

where, GMM = gross marketing margin, NMM = total net marketing margin obtained by all intermediaries e.g., s = suppliers and f = farmers, P_b= price prevailing in the first point of the marketing chain, P_e= price prevailing in the first point of the kth-segment of the marketing chain and c_i = marketing cost of ith component (e.g., transport cost, labour cost, processing cost, etc.).

Marketing system plays two roles: physical distribution of commodities and addition of value as these commodities change hands in the process. The marketing margins for these three commodities are examined based on data generated from various actors at two different locations, namely Bogra and Noakhali.[1] While Bogra is a surplus area for these commodities, Noakhali is a deficit area with only a seasonal surplus at the margin.

[1] Dhaka was not included in the vertical integration analysis as it is an urban centre where these commodities are not produced. It is a destination point where only a part of the value chain is physically located.

Market Structure and Intermediaries

The market for agricultural produce can be thought of as comprising two kinds of circuits – a simple, local circuit catering to localised demand, and a more complex long-distance circuit that connects local supplies to distant markets. Trade basically revolves around spatial arbitraging although some degree of arbitrage over time also exists, especially where commodities are storable. Complexity of market structure increases when processing and packaging are involved. Typically, the market consists of a number of essential intermediation roles carried out by numerous specialised agents. It is important to bear in mind that while different names are used to denote different agents and their functions, there are a number of overlapping roles and functions carried out by the same agent as well as the use of different local names to refer to the same or similar functions that can lead to confusion. These functions and the associated nomenclature are described below.

The most common types of intermediaries referred to in the vernacular are faria, bepari, aratdar and paikar. In addition, there are various local names in different regions of the country like cycle bepari, kandabepari, bharkiwala and laifaria. Things are further complicated by changing roles of some intermediaries with time although the names remain unchanged. The various types of intermediaries are defined below.

Faria: *Faria* operate in local village markets procuring supplies from growers in the market or at the farm gate and selling to beparis in the same market or to local aratdars. The dominant mode is for farias to sell to beparis within the village market. A faria has no fixed premises.

Bepari: A bepari trades long distance collecting from farias and growers in a village market, carrying out

some sorting, grading and bulking and connecting to an aratdar generally located in a larger market some distance away. Like the faria, the bepari is also an itinerant trader.

Aratdar: An aratdar is a broker or a commission agent who connects sellers (beparis) with buyers (other beparis, millers or processors, paikars or even retailers). A fixed commission is charged from both buyers and sellers so that the main goal of an aratdar is to have a high turnover. While the pure function of the aratdar is that of a broker, he is known to wear other hats as well, combining direct (speculative) trading and wholesaling in addition. The aratdar is really the central actor in the market playing the all-important role of enabling stranger-transactions, creating trust, and, in general, supporting credible contracts to be entered into and leading to repeat transactions. The aratdar is the ultimate guarantor in an exchange; without him, local village markets would remain unintegrated with larger regional markets, and with the rest of the country.

Paikar: Refers to a wholesale buyer purchasing directly from an aratdar or using a bepari to buy on his behalf.

Retailer: Procures supplies from a bepari or a paikar.

Processors: For some commodities, processors play an important role in the market. Thus the rice milling sector which has expanded astronomically in the last 20 years, uses alternative supply chains to ensure raw material availability. While (paddy) aratdars continue to play an important role, increasingly larger millers are collecting their supplies directly from growers using their hired agents. In fact, for the major supply centres, this seems to be the dominant supply chain for large millers. In addition to millers, there are traditional, small-scale paddy processors variously referred to as kandabepari,

cycle bepari, bharkiwala and laifaria in different parts of the country. They procure paddy from growers and use family labour to dry and parboil the paddy before milling and sell to consumers in the local village market. A further category of processors, chatals, used to be ubiquitous 20 years ago but has now drastically reduced in numbers. Their role was to dry, parboil and prepare the paddy for milling by independent millers. The chatal business was essentially a larger-scale version of the role of the small processor.

The structure of an agricultural market is illustrated in Figure 3.1 using the paddy-rice market as an example. In fact, amongst the different agricultural commodity markets, the paddy-rice market is the largest and the most complex although at its core, the basic mechanics are simple. The market, as already noted, has two clear components: a local circuit and a long-distance circuit. In the diagram below the local circuit is shown on the left of the figure where the main actor is the traditional (small) processor referred to as bharkiwala.

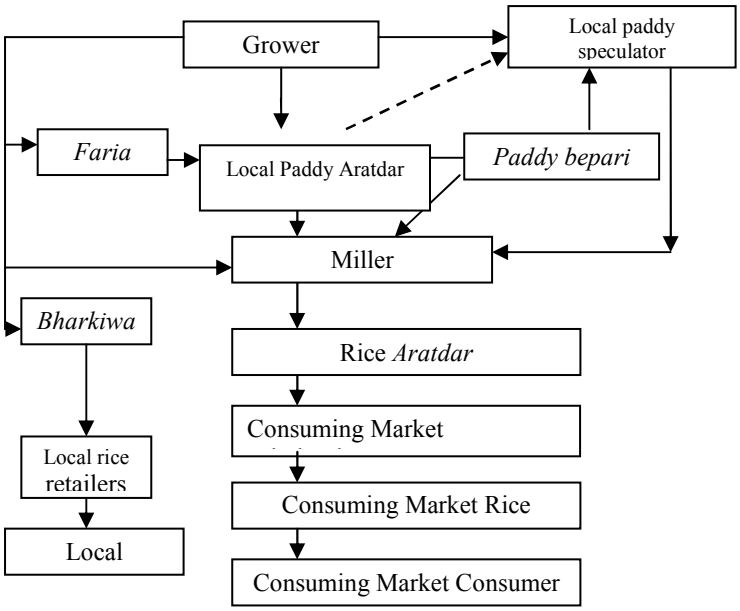
The bulk of the market is accounted for by millers and rice aratdars, the former procuring paddy supplies directly from growers through hired agents. A smaller flow is also captured by the paddy aratdars—a category that had virtually disappeared 10 years ago but has now made a small comeback. Rice aratdars dominate the milled rice market playing the most important role of connecting up with large consuming centres with their network of beparis and paikars.

The top right-hand corner of Figure 3.1 shows the paddy speculator: people with some surplus funds undertaking seasonal investments in commodities as a side business, in the hope of benefiting from expected price rise during the lean agricultural season when prices reach a peak. This segment of the market appears

to have been growing with easier access to finance and use of remittance earnings sent by migrant labour abroad.

Other agricultural markets like that of brinjal or potato are similar in structure except that the circuits are more basic, lacking in a processing sector although, as in the case of potato, there is a (cold) storage sector. In order to understand how the market specifically addresses the problems associated with developing and enabling credible, binding (and perhaps equitable) contracts, it is necessary to examine the nature of transactions entered into and how these are structured, patterned and sustained.

Figure 3.1: Paddy-Rice Trade Circuit



The marketing channels for brinjal, potato and rice are roughly as follows:

a. Brinjal:
   Farias□Beparis□Aratdars/Wholesalers□Retailers

b. Potato:
   Farias□Beparis□Aratdars/Wholesalers□Retailers

c. Rice:Paddy
   Farias□PaddyBeparis□PaddyAratdars/Wholesales
   □RiceMillers□RiceAratdars/Wholesalers□Rice
   Retailers

While some of the above intermediaries such as the miller are involved with production related activities, the others (e.g. farias, beparis, aratdars/wholesalers and retailers) are mostly related to distribution. An attempt was made to allocate the retail price across the different market agents or segments in terms of gross and net margins accruing to each. These margins may be compared with the formal and informal financial interest rates to see if such returns were abnormally high.

Brinjal

Our field work identified four major nodal points in the marketing chain for brinjal. These are farias, beparis, aratdars/wholesalers and retailers (Table 3.1). The monthly working capital ranges between Tk. 100,000 for wholesalers and above Tk. 5,000 for retailers. However, retailers are found to sell many kinds of vegetables along with brinjal so that the estimated working capital for retailing brinjal appears small. Transport and handling costs were found to range from Tk. 0.21 per kg at the faria level to as high as Tk. 1.00 per kg at the bepari, aratdar/wholesaler and retailer levels. The gross and net marketing margins of the agents are shown below, revealing that the gross marketing margins of the farias

are far below the financial rate of return on capital. In contrast, the beparis and the aratdars/wholesalers seem to earn a normal rate of return on their capital. The retailers earn the highest rate of return at 36 per cent. However, net marketing margins suggest that only the top half of the supply chain is financially viable.[2] The farias and beparis, it would appear, fail to earn a normal return on capital and could thus be said to engage in self-exploitation to eke out a meagre income. The rates of return to capital these groups earned would not allow them to survive in the market in the long run.

TABLE 3.1

MARKETING MARGINS OF BRINJAL, POTATO AND RICE

	Costs and Returns						Gross Marketing Margins		Net Marketing Margins	
	Price Paid	Marke-ting Costs	Total Direct Costs*	Inte rest Costs	Total Costs	Price Re-ceived	Tk./ Kg	(%)	Tk./ Kg	(%)
Marketing Costs and Margins of Brinjal (Tk./Kg)										
Faria	8.15	0.21	8.35 (38,462.97)	0.10	8.46	8.49	0.34	4.19	0.03	0.35
Bepari	8.49	1.20	9.69 (42,378.50)	0.12	9.81	10.21	1.73	20.33	0.41	4.19
Aratdar/ Whole saler	10.21	0.84	11.05 (1,07,582.50)	0.14	11.19	12.85	2.64	25.83	1.66	15.04
Retailer	12.85	0.77	13.62 (5,289.528)	0.17	13.79	17.42	4.57	35.58	3.63	26.67
Marketing Costs and Margins of Potato (Tk./Kg)										
Faria	9.18	0.17	9.35 (90,038.89)	0.12	9.47	9.75	0.57	6.25	0.28	3.04
Bepari	9.75	1.04	10.79 (2,65,954.94)	0.13	10.93	11.25	1.50	15.36	0.32	2.99
Aratdar/ Whole-saler	11.25	0.26	11.51 (16,53,598.16)	0.14	11.66	11.74	0.49	4.36	0.08	0.72
Retailer	11.74	0.55	12.29 (4,9811.09)	0.15	12.44	12.54	0.80	6.81	0.10	0.78

[2] For the purpose of net marketing margins, the opportunity costs of total fund devoted to the business and added to the total direct costs.

	Costs and Returns						Gross Marketing Margins		Net Marketing Margins	
	Price Paid	Marke-ting Costs	Total Direct Costs*	Inte rest Costs	Total Costs	Price Re-ceived	Tk./ Kg	(%)	Tk./ Kg	(%)
Marketing Costs and Margins of Rice (Tk./Kg)										
Paddy Faria	17.09	0.31	17.40 (24,9457.67)	0.22	17.62	20.83	3.74	21.87	3.21	18.45
Paddy Bepari	17.47	0.31	17.78 (5,88,696.64)	0.22	18.00	18.09	0.62	3.55	0.08	0.48
Paddy Aratdar/ Wholesaler	19.46	0.09	19.54 (47,28,486.4)	0.24	19.79	24.39	4.93	25.33	4.60	23.53
Rice Miller**	16.23	1.08	17.30 (63,78,761.28)	0.22	17.52	29.96	5.37	33.11	3.41	19.73
Rice Aratdar / Wholesaler	29.96	0.37	30.33 (15,770,996.63)	0.38	30.71	32.68	2.72	9.08	1.97	6.50
Rice Retailer	32.68	0.69	33.37 (3,11,098.29)	0.42	33.78	37.24	4.56	13.95	3.46	10.36

Source: Field Survey, 2010.

Notes: * The total direct costs involve the costs of procuring the commodity by the relevant actors in the chain. Figures in the parentheses indicate the total monthly costs in taka.

** Millers price paid is for paddy and price received is for rice.

Market intermediaries at various stages take about 53 per cent equivalent value of the retail price (Table 3.2). Of these, retailers receive the highest share of 26 per cent. However, two important aspects need to be considered before drawing any conclusion about retailers' margin. *First*, vegetables are highly perishable items and retailers add a premium to the price to offset the associated risks. *Second*, consumers tend to pick and choose better quality vegetables first, resulting in low quality residual items to be sold at lower prices; some part of the vegetables could also remain unsold at the end of the day. Retailers tend to add a premium to compensate for these losses. The aratdars/wholesalers capture about 15 per cent of the retail value. The farias

and the beparis together capture only about 12 per cent of retail price. Thus, the brinjal market appears to be competitive. Despite the competitive nature of the market, the growers' share of less than 50 per cent of the retail price is significantly lower than that observed for rice or potato, possibly related to its greater perishability.

TABLE 3.2
DISTRIBUTION OF MARGINS AMONG MARKET OPERATORS

Brinjal	Per cent	Cumulative per cent
Growers	46.75	46.75
Faria	1.96	48.71
Bepari	9.90	58.62
Aratdar/Wholesaler	15.14	73.76
Retailer	26.24	100
Potato		
Growers	46.75	46.75
Faria	1.96	48.71
Bepari	9.90	58.62
Aratdar/Wholesaler	15.14	73.76
Retailer	26.24	100
Rice		
Growers	69.55	69.55
Paddy Faria	1.51	71.06
Paddy Bepari	6.41	77.48
Paddy Aratdar/Wholesaler	4.01	81.49
Rice Miller	7.13	88.61
Rice Aratdar/Wholesaler	2.69	91.30
Rice Retailer	8.70	100

Source: Field Survey, 2010.

Potato

Similar to brinjal, four market intermediaries were identified in the supply chain for fresh potato. The monthly working capital requirements are similar to that of brinjal traders. The lowest marketing costs are incurred by farias at Tk. 0.17 per kg, while beparis incur

Tk.1 per kg - again very similar to that of brinjal traders. As beparis collect potato from growers and farias and transport these to the aratdars/wholesalers, their costs are higher. The gross marketing margins are low, ranging from 6 per cent for farias to more than 15 per cent for beparis. Net margins would appear to be uneconomic for all agents.

Growers appear to receive about three quarters of the retail value of potato. Both farias and aratdars/ wholesalers each receive about 4 per cent of the retail value. While low margins for the aratdars/wholesalers can be explained by the fact that they are really commission agents, low margins for the farias can be deemed as an act of self-exploitation, given few income-earning opportunities for the poorest segment in the chain. In addition, the lower degree of perishability leads to reduced margins for agents, as growers are under less pressure to dispose off their harvests quickly.

Rice

In the case of the rice market, six nodal points were identified where a separate and distinct agent operated. The monthly working capital for the agents in the supply chain ranged from Tk. 25,000 for the paddy farias to as high as Tk. 6.4 million for rice millers (Table 3.1), putting this market in a different league altogether. Marketing costs were found to be low, at Tk. 0.09 per kg for paddy aratdars/wholesalers and Tk. 1.08 per kg for millers.

There is a high variation in marketing margins for different agents: the gross marketing margin for paddy beparis was about 4 per cent, which is very small compared to the opportunity cost of capital, while the gross marketing margin of 33 per cent for millers is high. The net marketing margin, on the other hand, was the

highest for paddy aratdars/wholesalers at about 24 per cent with millers coming next (about 20 per cent).

The paddy growers appear to receive about 70 per cent of the retail value of rice. The paddy farias and beparis together receive about 8 per cent of the retail value, while paddy aratdars/wholesalers get about 4 per cent. The low shares accruing to aratdars/wholesalers can be explained by the fact that they are really commission agents. In the rice segment of the supply chain, millers get around 7 per cent and the rice aratdars/wholesalers get another 3 per cent of the retail value. The highest share goes to the rice retailers with about 9 per cent of the retail value accruing to them.

Thus, for perishable items like brinjal, marketing margins are higher at the latter stages. Thus, for wholesalers and retailers, it is more than double that of farias and beparis. The small volume offered by the farias and beparis makes their bargaining power weak. For potato, the marketing margins do not follow any systematic pattern. If it is compared with brinjal, the potato market appears to be more efficient. In contrast, the marketing margins for rice are higher than that of potato or brinjal at almost every segment of the chain.

3.3 Spatial Integration of Markets

Perfectly integrated markets are also assumed to be efficient. Tomek and Robinson (2003) define the two axioms of the regional price differences theory: (i) the price difference in any two regions or markets involved in trade with each other equals the transfer costs, and (ii) the price difference between any two regions or markets not involved in trade with each other is smaller than the transfer costs.

Consider two spatially different markets where the price of a given good in time t is P_{1t} and P_{2t} respectively. The two markets are considered integrated, if the price in market 1 equals the price in market 2 adjusted for transport costs, K_t:

$$P_{1t} = P_{2t} + K_t \qquad (3.1)$$

Trade between the two markets occurs only if $|P_{1t} - P_{2t}| > K_t$. To put it in another way, arbitrage ensures that prices of the same good traded in spatially separate markets become equalised. Early studies of spatial integration employed correlation and regression analysis. These studies usually tested some form of the LOP. Consider the equation:

$$P_{1t} = \beta_0 + P_{2t} \qquad (3.2)$$

According to the strong version of LOP, prices of a given good in spatially separated markets are equal, and they move together perfectly over time. Using the coefficients of equation (3.2), the necessary conditions are $\beta_0 = 0$ and $\beta_1 = 1$. In real life, however, the strong version occurs only very rarely: therefore, the weak version of LOP was also defined. The weak version states that only the price ratio is constant, the actual price level is different due to transport and other transfer costs. Using again the notation of equation (3.2), the necessary restrictions are $\beta_0 \neq 0$ and $\beta_1 = 1$. With the evolution of time series econometrics, recent papers test a more general (wider) notion of horizontal integration of spatially separated markets. In this case, the long-run co-movement of prices is analysed, the strong and weak versions of LOP, however, remain testable hypotheses.

To avoid the danger of spurious regression with potentially non-stationary variables, cointegration needs to be tested. The Johansen cointegration procedure is

based on estimating the following Vector Error Correction Model (VECM):

$$\Delta P_t = \Pi P_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta P_{t-i} + \varepsilon_t \qquad (3.3)$$

where P_t = [P^1_t, P^2_t]′, a (2 x 1) vector containing the prices in districts 1 and 2, both I(1), $\Gamma_i$are (2x2) vectors of the short-run parameters, Π is (2x2) matrix of the long-run parameters, $\varepsilon_t$is the white noise stochastic term. Π is a product of two terms written as

$$\Pi = \alpha\beta' \qquad (3.4)$$

where matrix α represents the speed of adjustment to disequilibrium and β is a matrix which represents up to (n-1) cointegrating relationships between the non-stationary variables. Trace and maximum Eigen-value statistics are used to test for cointegration. Once equation (3.3) is estimated one can proceed to test for weak exogeneity and then for linear restrictions on the βvector. One obvious candidate would be to test whether the elements of the vector are of the (-1, 1) form, i.e. whether the markets are perfectly integrated. The terms of vector α(factor loading matrix) measure the speed at which the variables adjust towards the long-run equilibrium after a price shock. Vector α of the weakly exogenous variable equals zero. To find the direction of the Granger causality between the two price series, restrictions are tested on the vector α.

Given cointegration, two hypotheses are of interest. *First*, the null hypotheses that β_1=1 and β_2=-1 using a likelihood ratio statistic are tested. Non-rejection of the null implies perfect market integration, while rejection implies imperfect market integration. *Second*, the nulls of long-run non-causality following Mosconi and Giannini (1992) were tested separately for α_1=0 and α_2=0 using LR-statistics; in (3.3), when k=1, this is equivalent to testing Granger non-causality. Consider the case

where $\alpha_2=0$: in the second equation in (3.3) with ΔP_{2t} as the dependent variable, the error correction term (third term on the RHS) is excluded and the long-run solution to P_{2t} is not affected by departures from the equilibrium defined by the cointegrating vector; in this case, the market in which P_{2t} is determined is dominant. Similarly, P_{2t} does not cause P_{1t} if $\alpha_1=0$ in (3.3) and the market in which P_{1t} is determined is dominant. Feedback between P_{1t} and P_{2t} is also possible and is implied by $\alpha_1\neq0$ and $\alpha_2\neq0$. Estimates of α_1 and α_2 indicate speeds of adjustment of P_{1t} and P_{2t} to disequilibrium error in each period.

The price data used consist of monthly nominal wholesale prices of coarse rice (taka/ton) for Dhaka and 11 regional markets for the post-liberalisation period, January 1995–December 2007. The three rice seasons are aus, aman and boro. Production in the *aus* season is small (5–10 per cent of total production) so that only the price of *aman* (November to April) and *boro* (May to October) were used.

The source of the data is the DAM that has offices in each district of Bangladesh staffed by an officer and other investigators. Weekly wholesale prices for each crop are collected from a sample of local markets. The markets are typically in headquarters' towns but may be in nearby villages; also included are some government-notified markets. Sample prices are assumed to be representative of prices in all local markets, and their simple arithmetic average is the weekly wholesale price for the district. All weekly prices are discussed and checked for consistency each month at the district level before they are sent to the DAM head office in Dhaka which uses simple arithmetic averages to derive monthly prices for publication.

Tables 3A.1-3A.3 present the results of testing for unit roots in each price series for brinjal, potato and rice

using ADF (Dickey and Fuller 1981), PP (Phillips and Perron 1988) and KPSS (Kwiatowski, Phillips, Schmidt and Shin 1992) tests. Irrespective of whether a trend is included in the model or not, all series are I(1).Thus, one seeks cointegrating relationships between the pair of prices in each of the six regional markets. In doing so, a "modified" Ravallion model was applied along the following line of argument: Each divisional market is cointegrated with one hinterland market and all divisional markets are cointegrated.

3.4 Divisional and Hinterland Price Pairs of Brinjal, Potato and Rice

The first step of the Johansen procedure is to select the order of the VAR for each price relationship. The LR-statistic, adjusted for small samples, is used to test the null hypothesis that the order of the VAR is k against the alternative that it is six where k=0, 1, 2 . . . 5 and for all cases, k=1. The Johansen procedure and trace statistics are used to test for the presence of a cointegrating vector in each price relationship using the so-called Pantula principle. For all price relationships of brinjal, potato and rice, one cointegrating vector (r=1) each was found and the results are reported in Table 3.3. Thus, the LOP holds between the sets of regional markets. The same table also shows the results of hypothesis tests.

First, the null hypothesis that β_1 =1 and β_2=-1 is rejected in all cases of brinjal, implying that imperfect market integration for this commodity is widespread in Bangladesh. In contrast, the null cannot be rejected in any of the cases for potato, implying that market for this commodity is perfectly integrated. The status of market integration for coarse rice is mixed: market integration is perfect for all regional markets except Dhaka-Mymensingh and Khulna-Kushtia pairs. The rice market results suggest that while markets are well integrated

generally, there are pockets or areas where markets are not well integrated. These areas may need special attention of the government and thus requires identification, monitoring and further examination.

TABLE 3.3

MAXIMUM EIGEN VALUE STATISTICS, TRACE STATISTICS, AND HYPOTHESIS TESTS

Market Pairs	$H_0(H_1)$	$\lambda_{\text{-Max}}$	Trace	H_0: B1=-1; β2=1	H_0: $\alpha_1=0$	H_0: $\alpha_2=0$
			Brinjal			
Barisal	r=0(r=1)	45.559*	52.097*	8.038*	9.374*	25.709*
Bhola	r≤1(r=2)	6.538	6.538	[0.005]	[0.002]	[0.000]
Chittagong	r=0(r=1)	14.221*	14.662*	20.347*	3.029*	3.888*
Comilla	r≤1(r=2)	0.441	0.441	[0.000]	[0.082]	[0.049]
Dhaka	r=0(r=1)	23.665*	24.169*	7.456*	0.025	28.284*
Munshiganj	r≤1(r=2)	0.503	0.503	[0.006]	[0.875]	[0.000]
Khulna	r=0(r=1)	33.398*	38.888*	6.106*	1.511	9.961*
Kushtia	r≤1(r=2)	5.490	5.490	[0.014]	[0.219]	[0.002]
Rajshahi	r=0(r=1)	19.739*	19.908*	1.002	16.837*	1.274
Bogra	r≤1(r=2)	0.169	0.169	[0.317]	[0.000]	[0.259]
Sylhet	r=0(r=1)	20.025*	20.664*	19.623*	3.944*	3.194*
Moulavi Bazar	r≤1(r=2)	0.638	0.638	[0.000]	[0.047]	[0.074]
			Potato			
Barisal	r=0(r=1)	18.794*	20.875*	0.063	0.067	11.525*
Bhola	r≤1(r=2)	2.081	2.081	[0.801]	[0.796]	[0.001]
Chittagong	r=0(r=1)	18.921*	20.890*	0.045	0.247	11.841*
Comilla	r≤1(r=2)	1.969	1.969	[0.840]	[0.619]	[0.001]
Dhaka	r=0(r=1)	31.700*	33.727*	0.282	0.192	5.756*
Munshiganj	r≤1(r=2)	2.027	2.027	[0.595]	[0.662]	[0.016]
Khulna	r=0(r=1)	18.118*	20.041*	1.234	3.020*	0.002
Kushtia	r≤1(r=2)	1.923	1.923	[0.267]	[0.082]	[0.960]
Rajshahi	r=0(r=1)	19.863*	22.816*	0.052	0.999	6.171*
Bogra	r≤1(r=2)	2.953	2.953	[0.820]	[0.318]	[0.013]
Sylhet	r=0(r=1)	16.869*	20.040*	0.135	0.924	3.861*
Moulavi Bazar	r≤1(r=2)	3.171	3.171	[0.714]	[0.336]	[0.049]
			Coarse Rice			
Barisal	r=0(r=1)	27.164*	28.401*	0.338	11.999*	1.012
Patuakhali	r≤1(r=2)	1.236	1.236	[0.561]	[0.001]	[0.314]
Chittagong	r=0(r=1)	25.425*	26.597*	0.392	3.316*	8.334*

Market Pairs	$H_0(H_1)$	$\lambda_{\text{-Max}}$	Trace	H_0: B1=-1; $\beta 2=1$	H_0: $\alpha_1=0$	H_0: $\alpha_2=0$
Feni	r≤1(r=2)	1.172	1.172	[0.531]	[0.069]	[0.004]
Dhaka	r=0(r=1)	31.448*	33.761*	6.171*	3.831*	7.491*
Mymensingh	r≤1(r=2)	2.313	2.313	[0.013]	[0.050]	[0.006]
Khulna	r=0(r=1)	28.680*	30.247*	8.138*	3.187*	10.228*
Kushtia	r≤1(r=2)	1.567	1.567	[0.004]	[0.074]	[0.001]
Rajshahi	r=0(r=1)	32.156*	33.943*	0.901	2.343	12.384*
Naogaon	r≤1(r=2)	1.786	1.786	[0.342]	[0.132]	[0.000]
Sylhet	r=0(r=1)	27.873*	29.079*	1.090	3.215*	4.037*
Moulavi Bazar	r≤1(r=2)	1.206	1.206	[0.297]	[0.073]	[0.045]
Dhaka	r=0(r=1)	18.181*	21.254*	10.979*	18.607*	4.521*
Kolkata	r≤1(r=2)	3.074	3.074	[0.001]	[0.000]	[0.034]

Source: Authors' estimates based on DAM data.

Note: Figures with asterisk are significant at 5 per cent probability level; those with brackets are p-values.

TABLE 3.4

NORMALIZED VECTORS OF COINTEGRATING AND ADJUSTMENT COEFFICIENTS

Market Pairs	Intercept	β_2	α_1	α_2
		Brinjal		
Barisal	721.506	-1.686	0.377	0.732
Bhola	151.716	(0.136)	(0.085)	(0.105)
Chittagong	-	-0.709*	-0.373	0.123
Comilla	-	(0.030)	(0.184)	(0.222)
Dhaka	-	-1.121*	0.002	0.444
Munshiganj	-	(0.043)	(0.168)	(0.111)
Khulna	-316.195	-0.736*	-1.064	-0.500
Kushtia	(60.735)	(0.065)	(0.220)	(0.207)
Rajshahi	-	-1.012*	-0.481	0.125
Bogra	-	(0.022)	(0.254)	(0.239)
Sylhet	-	-1.144*	-0.188	0.346
Moulavi Bazar	-	(0.029)	(0.195)	(0.216)
		Potato		
Barisal	23.129	-0.999*	-0.129	0.563
Bhola	(30.180)	(0.033)	(0.288)	(0.323)
Chittagong	42.990	-0.986*	0.076	0.513

Market Pairs	Intercept	β_2	α_1	α_2
Comil la	(52.741)	(0.058)	(0.162)	(0.176)
Dhaka	-35.810	-0.976*	-0.711	0.449
Munshiganj	(13.525)	(0.016)	(0.495)	(0.471)
Khulna	-52.778	-0.962*	-0.461	-0.045
Kushtia	(31.036)	(0.037)	(0.261)	(0.281)
Rajshahi	-8.346	-0.995*	-0.232	0.404
Bogra	(42.012)	(0.053)	(0.203)	(0.225)
Sylhet	-13.781	-0.983*	-0.259	0.205
Moulavi Bazar	(49.311)	(0.052)	(0.212)	(0.220)
		Coarse Rice		
Barisal	-97.336	-0.956*	-0.602	0.062
Patuakhali	(60.466)	(0.045)	(0.169)	(0.172)
Chittagong	-7.784	-0.988*	-0.140	0.492
Feni	(64.685)	(0.049)	(0.124)	(0.151)
Dhaka	116.170	-1.110*	-0.237	0.413
Mymensingh	(62.457)	(0.048)	(0.161)	(0.155)
Khulna	-113.339	-0.918*	-0.364	0.618
Kushtia	(37.726)	(0.029)	(0.241)	(0.229)
Rajshahi	29.647	-1.035*	-0.277	0.613
Naogaon	(44.707)	(0.035)	(0.155)	(0.178)
Sylhet	107.207	-1.045*	-0.252	0.326
Moulavi Bazar	(52.913)	(0.039)	(0.145)	(0.148)
Dhaka	236.713	-1.464*	-0.518	-0.179
Kolkata	(162.924)	(0.099)	(0.098)	(0.077)

Source: Authors' estimates based on DAM data.
Note: Figures in the parentheses are standard errors.

Second, the two nulls of non-causality, i.e.,that $\alpha_1=0$ and, that $\alpha_2=0$ are tested. For brinjal results show that except in three cases viz. Barisal-Bhola, Chittagong-Comilla, and Sylhet-Moulavi Bazar which show bi-directional causality, uni-directional causality is observed in the other three market pairs. For potato the Granger-causality seems to be uni-directional for all six pairs of markets. For coarse rice, as many as four markets show bi-directional causality. While uni-directional causality implies presence of dominant

market, the bi-directional causality implies feedback relationship.

Table 3.4 shows the cointegrating vector for each relationship. It may be noted that slope coefficient is close to unity once again testifying that markets are integrated. However, the negative intercepts for several market pairs are difficult to justify. Also shown in Table 3.4 are the adjustment coefficients, $\alpha_1$and α_2, which show the speeds at which ΔP_{1t} and ΔP_{2t} adjust towards each single long-run cointegrating relationship. There is a wide variation in the speed of adjustment for brinjal, potato and rice: for brinjal, it ranges from as low as 0.002 to as high as 1.06; for potato, it ranges between 0.04 and 0.7; and for rice, it ranges between 0.06 and 0.6. For the bi-directional causality cases, shock to either price was found to be permanent.

Divisional Prices of Brinjal, Potato and Rice

For all price relationships of brinjal, potato and rice, one cointegrating vector (r=1) each was found and the results are reported in Table 3.5. Thus, the LOP holds among the divisional markets. As found earlier, LOP holds between the divisional and hinterland markets. Hence, it may be claimed that all divisional and hinterland markets are integrated taken together, i.e., the modified Ravallion model is a reasonable hypothesis. Table 3.6 shows the coefficients of the cointegration vectors and the adjustment coefficients. While coarse rice and potato have intercepts in their respective long run relationships, brinjal has no such intercept. Most of the coefficient and adjustment vectors are significant, implying long run stable relationships. However, as Table 3.7 shows, some of the divisional prices may be safely excluded from the long run relationship and hence these prices do not adjust to any long run disequilibrium.

TABLE 3.5

MAXIMUM EIGEN VALUE STATISTICS AND TRACE STATISTICS OF THE DIVISIONAL PRICES

$H_0(H_1)$	$\lambda_{\text{-Max}}$	Trace	$\lambda_{\text{-Max}}$	Trace	$\lambda_{\text{-Max}}$	Trace
	Brinjal		Potato		Coarse Rice	
r=0(r=1)	57.760	122.240	60.557	151.501	48.027	155.108
r≤1(r=2)	26.242	64.480	33.893	90.944	36.426	107.081
r≤2(r=3)	17.450	38.238	24.907	57.051	29.419	70.655
r≤3(r=4)	11.660	20.788	17.553	32.144	25.346	41.236
r≤4(r=5)	9.103	9.128	13.015	14.591	14.498	15.890
r≤5(r=6)	0.025	0.025	1.576	1.576	1.391	1.391

Source: Authors' estimates based on DAM data.

Dhaka and Kolkata Prices of Rice

Given that domestic markets are generally well-integrated, it would be useful to examine whether the same is true for cross-border markets. As Bangladesh tends to import significant quantities of rice from India, it is particularly important to explore whether Bangladeshi and Indian rice markets are integrated. This is done by examining Dhaka and Kolkata coarse rice prices.[3] As reported in Table 3.3, a unique cointegration vector is observed between Dhaka and Kolkata wholesale prices; however, the null of $\beta_2 = -1$ is resoundingly rejected. Thus, integration in these two markets can be said to be less than perfect. Further, similar to some divisional markets, the hypotheses that $\alpha_1=0$ and $\alpha_2=0$ are also rejected, implying that neither of these markets dominate the other. Instead, a feedback relationship between Dhaka and Kolkata prices is found, which is unexpected. This result is counter-intuitive as rice trade

[3] The authors are grateful to Ciro Fiorillo, Chief Technical Advisor, FAO, Dhaka, for providing monthly wholesale price of coarse rice in Kolkata, West Bengal, India for the period June 2005 to November 2008.

between India and Bangladesh is unidirectional from the former to the latter. The speed of adjustment towards equilibrium ranges from low 0.18 to as high as 0.52, implying that economic agents in coarse rice markets correct these ranges of disequilibrium each period. As there is evidence of bi-directional causality, shocks to either the Dhaka or the Kolkata price takes time to dissipate.

The finding that the two markets are less than perfectly integrated implies that each market takes the price signals of the other into account only partially. It is likely that there are other exporting countries besides India that influence price behaviour in Dhaka. Dhaka prices could also affect Kolkata prices if there is a substantial price differential, through informal trading over a long porous border.

TABLE 3.6

NORMALIZED VECTORS OF COINTEGRATING AND ADJUSTMENT COEFFICIENTS

Markets	β	α	β	α	β	α
	Brinjal		Potato		Coarse Rice	
Constant	-	-	-33.417	-	-331.175	-
	-	-	(12.172	-	(211.189)	-
Barisal	1.000	0.018	1.000	-1.471	1.000	-0.067
	-	(0.019)	-	(0.486)	-	(0.041)
Chittagong	-0.447	0.035	-0.003	-0.626	2.066	-0.103
	(1.139)	(0.021)	(0.081)	(0.479)	(0.608)	(0.032)
Dhaka	3.542	0.039	-0.347	0.173	2.839	-0.073
	(1.132)	(0.033)	(0.099)	(0.546)	(0.782)	(0.043)
Khulna	12.834	-0.001	-0.636	-0.005	-0.668	-0.039
	(2.021)	(0.016)	(0.086)	(0.548)	(0.826)	(0.040)
Rajshahi	-13.797	0.076	0.088	-1.008	-4.490	0.073
	(2.163)	(0.018)	(0.074)	(0.581)	(0.720)	(0.034)
Sylhet	-3.473	0.054	-0.105	-1.052	-0.632	0.016
	(1.019)	(0.021)	(0.054)	(0.505)	(0.721)	(0.036)

Source: Authors' estimates based on DAM data.

Note: Figures in the parentheses are standard errors.

TABLE 3.7

EXCLUSION RESTRICTIONS AND WEAK EXOGENEITY TESTS
(H_0: β_j=0, H_0: α_i=0)

Markets	β	α	β	α	β	α
	Brinjal		Potato		Coarse Rice	
Barisal	0.435	0.046	6.108*	3.520*	0.677	0.053
	[0.510]	[0.830]	[0.013]	[0.061]	[0.411]	[0.818]
Chittagong	0.423	0.505	0.024	1.320	0.684	1.058
	[0.515]	[0.477]	[0.878]	[0.251]	[0.408]	[0.304]
Dhaka	0.237	0.602	1.068	0.065	9.396*	9.999*
	[0.626]	[0.438]	[0.302]	[0.799]	[0.002]	[0.002]
Khulna	6.548*	0.371	4.548*	0.154	0.049	0.303
	[0.010]	[0.542]	[0.033]	[0.695]	[0.825]	[0.582]
Rajshahi	6.718*	5.582*	5.041*	1.677	0.121	1.606
	[0.010]	[0.018]	[0.025]	[0.195]	[0.728]	[0.205]
Sylhet	2.607*	1.088	5.489*	0.055	10.860*	4.331*
	[0.106]	[0.297]	[0.019]	[0.814]	[0.001]	[0.037]

Source: Authors' estimates based on DAM data.
Note: Figures with brackets are p-values.

3.5 Conclusion

This chapter breaks new ground in our understanding of agricultural commodity markets in Bangladesh. It examines both vertical and spatial integration and reveals a complex picture where, while markets are generally well-integrated and agents do not reap supra normal profits on average, there is considerable variation by commodity and regions. It also raises new questions, for example, about the low return faced by farias and beparis (which is well below the economic rate of return on capital), the bi-directional causality between Indian and Bangladeshi prices, and the relative lack of integration for brinjal and in some cases, for rice markets. It also confirms some popular notions, especially related to the significantly higher net returns earned by aratdars, wholesalers and millers. At the conceptual level, the chapter demonstrates that the

modified Ravallion model is a good description of agricultural markets in Bangladesh.

Two types of policy implications follow from the above findings: for market pairs with dominant markets, any intervention should target the dominant one(s), while in the case of bi-directional causality, interventions would need to be carried out in both. In the case of perfect integration, the impact will be one-to-one, while for imperfect integration, this will be partial, with some mismatch.

CHAPTER 4

MARKET INSTITUTIONS

4.1 Introduction: Conceptualising Markets

The discussion in chapter 3 centred essentially on market performance in terms of vertical and spatial integration, which meant looking at prices, costs and margins. The discussion, however, ignored the market participants themselves, namely producers, traders and millers as well as the institutional arrangements within which they interact each other, negotiate terms of exchange and enter into binding contracts. The ability of the market to generate binding contracts at low cost is crucial for efficacy of market. Market performance cannot be understood without reference to these dynamics, which, among other things, determine entry and exit, exchange obligations, the extent of tied-transactions practiced (and generally whether returns to trade are free or tied) and the ease with each complex forms of exchange are established. A better understanding of the underlying market dynamics is particularly important for policy.

The fundamental function of a market is to enable exchange. At the most basic level, this is simultaneous exchange, conducted face to face involving a direct transfer of goods or services, with or without the use of a medium of exchange (money, gold, etc.). If money is used, payment must necessarily be in cash. Before the physical transfer of goods actually occurs, terms are negotiated, prices are fixed, and quality and weight are ascertained. It is easy to see that even in such a basic level of transaction, there may be significant problems

that need to be overcome. *First*, there is the problem of bargaining power of each party determined by class, caste, social position, hierarchy, etc. which may favour the "superior" party. *Second*, there is the problem of "lemons" due to asymmetric information which may not be immediately apparent from physical verification of goods (e.g. adulterated food). *Third*, there may be inadequate market information, for example, on prices that would enable buyers to arrive at an equilibrium price.

If more complex or sophisticated exchange is to occur, additional problems have to be resolved. Thus, long-distance trade imposes additional risks as exchange will have to be conducted through agents or intermediaries (rather than being face to face), giving rise to the so-called "principal-agent" problem. Similarly, long-distance transactions and transactions involving credit (especially longer-term credit) involve significant risk elements that relate to potential default (in repayment, receipt of goods as per contract (e.g. in terms of quality, grade, timeliness of delivery and repayment), etc. Thus, for non-face to face exchange to occur, traders, separated by space or time, must be able to engage in credible contracts at low cost. This is the central problem that a relatively more complex market has to resolve. In the case of even a basic market, the problem is to ensure that traders stick to their side of the bargain. It should be easy to guess that without repeated exchange, a market would soon cease to exist.

A well-functioning market requires a set of low-cost, formal and informal rules and enforcement mechanisms. Thus, market roles that are of special interest relate to three distinct aspects: (a) reduction in information asymmetries, (b) enabling low-cost contract enforcement/dispute resolution, and (c) enhancing competition.

This ideal is best thought to be approached by impersonal markets associated with those in advanced economies. Indeed, some authors have gone so far as to argue that this is the central problem of development of underdeveloped countries. It is instructive to refer to North who states: "…. The dilemma posed by impersonal exchange is central to the major issues of development", and again "…the inability of societies to develop effective, low cost enforcement of contracts (that is, impersonal contracts) is the most important source of both historical stagnation and contemporary underdevelopment in the third world" (North 1990: 54).

It is argued by some that the rise and sustainability of impersonal markets in advanced economies is based on both internal and external institutions (rules, norms, values). Thus, the legal framework and a constant threat of enforcement are seen to be critical in providing the predictability and stability needed for markets to work well. In addition to legal rules, social and market values that are internally generated (honesty, fairness) play an even more crucial role, so much so that much of the time, the market remains self-regulated without needing legal (external) enforcement of contracts. In other words, values are "ubiquitous behavioural realities that play a critical role in facilitating the trustworthiness, fairness, and honesty that promote cooperation between individuals, firms, and institutions, and within society as a whole" (Goodenough and Cheney 2008, xxiv). Values-based approaches, where they work, provide private, internal institutions that come at a much lower monetary cost compared to externally imposed institutions. Indeed, an over-reliance on external rules may crowd out internal (low cost) ones. Specific mechanisms and institutions are discussed in greater detail below.

The Role of Middlemen

In more complex markets, the role of the middleman is to remove the risks associated with transactions between strangers, in effect acting as trust intermediaries. In addition, rating agencies, third-party experts or inspectors and bonding and insurance agencies provide information and play a risk-bearing or risk-sharing role—all intended to encourage stranger-transactions. Numerous strategies are encouraged by businesses to make transactions easier, friendlier and less risky including discounts, advertisements, credit, etc.

Contract Law

Contract law provides an external incentive that promotes a party's ability to trust that the other party will behave correctly. In other words, a contract law can provide additional assurance (at the margin) that the risks of trading will be small. This happens in three ways: (a) remedy for breach of promise is a distinct possibility (and can be of huge psychological benefit as well), (b) the flexibility of contract law allows parties to structure contractual provisions in a way that minimises their concerns, and (c) the law can support existing norms, which will then be further strengthened (O'Hara 2008).

Building Trust and Norms

Trust enhancing institutions generally evolve through the efforts of participants in long-term, repeated market exchange environments. These allow traders an opportunity to establish a reputation as a dependable participant in exchange, making transactions less costly, more stable and more effective than otherwise would be the case. For example, in a game of snatch, where

traders face a choice between snatch and trade given a one-off exchange, results in snatch almost always, thus preventing a market from developing (Schwab and Ostrom 2008). Once some simple norms are introduced into this setting, private exchange is enabled. The Hobbesian world (of no trade) is described as follows: "….There is no place for industry; because the fruit thereof is uncertain; and consequently no culture of the earth; no navigation, nor use of the commodities that may be imported by sea; no commodious building; no instruments of moving or removing…" (Hobbes 1960: 80). In this world there is no trust and no exchange. However, a number of scholars have differed with this view based on the common observation that even in very adverse situations people trust one another much more frequently than is theoretically predicted (Camerer 2003; Ostrom and Walker 2003).

Various modifications of the 'snatch' game have been demonstrated to show that different (more desirable) equilibria are possible. One possibility is that players adopt norms that lead them to derive utility from self-consciously avoiding snatch. Thus, Crawford and Ostrom (2005) model this utility ("warm glow") as a delta (δ) parameter that is added to the utility of the player who follows such a norm. If delta is large enough to offset the utility from snatch, a new Nash equilibrium is generated that leads to exchange instead of snatch. This type of a game could be an appropriate way to model exchange in close-knit societies with repeated interactions amongst members belonging to the same community.

A second alternative is the establishment of law and order, by creating a new position in the community with the power of sanctioning opportunistic or undesirable behaviour. As long as the sanction involves a loss of

utility that is larger than the expected gain from snatching, a Nash equilibrium favouring exchange is established (Ostrom 2005). However, passing and enforcing rules involves costs leading to a second-order, collective action problem: there is no incentive for players to monitor and sanction others, and in any case, this is never perfect—the guilty are not always caught and the innocent do not always escape punishment! A third possibility is that players develop a reputation for fair-play over time. There is enough evidence to show that reputation effects do play a critical role in decisions regarding with whom to trade (Colson 1974, Sally 2002). It is believed, however, that for reputation to lead to trust, institutions are needed that are able to verify and disseminate reliable information in the market (Schwab and Ostrom 2008). In other words, learning about reputation is likely to be costly in a context of imperfect information. Thus, trust enhancing institu-tions can help manage reputation information in a market by ensuring that this is available quickly, reliably and cheaply. Thus reputation, trust and reciprocity provide a strong interactive brew that can sustain exchange and make snatching costly. If there are serious impediments to the flow of information (relating to reputation), it will not have the same deterrent effect, leading to a growing incidence of snatch.

Institutional Design

Institutions need to be context specific. Selling farm products is quite different from selling options or buying in futures markets. These differences emanate from the incidence and distribution of risks, and information flows relating to key variables. In other words, it is critical to identify the snatch potential, frequency, distribution and costs in order to design an appropriate institution for a specific commodity.

Secondly, poorly implemented institutional solutions can have the exact opposite effect than the one intended, i.e. it can crowd out trust rather than enhancing it (Schwab and Ostrom 2008). Any functioning system has evolved its own rules and norms, its own mechanics which are not always well understood. Thus, ill-conceived attempts to tinker with these through externally designed institutions or rules can easily backfire.

Methodological Note

A case study approach was adopted to generate information on transactions and markets from a number of markets previously studied in 1989 in Dhaka, Bogra and Noakhali. While the main focus was on the paddy-rice market, the largest agricultural market in Bangladesh, two other commodities were also examined, namely potato and brinjal.

In depth interviews were conducted with a wide range of market participants as well as producers and millers in a variety of markets (Table 4.1). At the market level, the role of samitis in establishing market order was examined along with market norms that sustain trade. At the level of transactions, the myriad forms of transaction-relationships were examined to understand how credible exchange was established and sustained.

The markets examined by Crow and Murshid (1989) were revisited to provide a sense of transformation of market structures and exchange relations over a period of 20 years. These markets were originally chosen as "advanced markets" (in Bogra), backward markets (in Noakhali) and large, urban markets (in Dhaka).

TABLE 4.1

THE NUMBER OF TRADERS AND GROWERS INTERVIEWED, BY LOCATION

Product/	Paddy/Rice			Brinjal			Potato			*Total*
Actors	Bogra	Noakhali	Dhaka	Bogra	Noakhali	Dhaka	Bogra	Noakhali	Dhaka	
Grower	3	3		3	3		3	3		*18*
Faria	6	5		6	6		6			*29*
Bepari	6	6		6	6		8	4		*36*
Aratdar (Paddy)	5	5								*10*
Miller	3	3								*6*
Aratdar (Rice)	5	-		3	3		1	5	4	*21*
Whol esaler		6	17					6		*29*
Retailer	3	3	5	3	3	3	3	10	2	*35*
Total	*31*	*31*	*22*	*21*	*21*	*4*	*25*	*23*	*6*	*184*

Note: In addition, 4 FGDs (2 before harvest and 2 after) were conducted in two villages of Bogra. Similarly, 4 FGDs were conducted in Noakhali.

4.2 Generating Credible Contracts – A Focus on Transactions

Market exchange requires that potential trading partners are able to come together on the basis of good market information and enter into credible, binding contracts. As markets evolve, the nature and complexity of contracts increase to allow for additional risks, e.g. arising from long-distance trade. A distinction may be made between the terms of a contract that is negotiated and market-wide (formal or informal) mechanisms that are intended to facilitate smooth exchange. In this section, the main focus is on the transactions themselves, and especially on more complex types of transactions.

While individual traders are left to their own to devise credible transaction relationships, a crucial role is played by the institution of the aratdari. Several

recurrent features may be observed in the manner in which traders try to minimise risk.

Establishment of trust amongst parties is generated through a long process of repeated transactions, although this can sometimes be by-passed if favourable references are obtained from a senior, well-established trader. In generally, initial transactions are small but are gradually scaled up over time as a history of successful transactions is built up:

- Where parties do not know each other well enough, transactions are strictly on cash and face to face;
- Complex transactions (involving credit financing or deferred payments) require a successful track record, and use of a third-party agency as guarantor: the key third-party agency role in the rice market, for example, is played by the rice aratdar and paddy aratdar, allowing unrelated parties to enter into exchange in relative safety and security;
- However, this requires that *aratdars* need to invest time and effort in building a client-base of trusted trading partners in the first place
- Tied exchange where finance/credit is used to alter terms of trade in favour of the dominant party. Significant volume of trade in Bangladesh is of this type.

Third party agency is not always used or needed, e.g. when large millers are able to tie up directly with growers or wholesalers—but this introduces the principal-agent problem that takes time (and cost) to resolve, and has therefore met with limited success (e.g.

smaller millers would find the cost of direct procurement through agents prohibitive).

Tied Transactions Involving Farmers-Traders or Traders-Traders

Larger farmers are able to obtain a "free" (untied) market price for their produce in open, face-to-face transactions but small and marginal farmers are often tied into credit-based relations requiring them to surrender a part of the produce at a significantly lower price than prevalent in the market. Poorer growers often accept cash advances from traders, millers or their agents which have to be repaid after harvest at a lower price (involving an implicit rate of interest). At the same time, surplus farmers are known to provide credit in kind (produce) to traders or millers which have to be repaid in cash at the end of the season, at the highest price of the season. The former is widespread in the backward (deficit) area, especially in the chars of Noakhali, while the latter is well-known in the advanced (surplus) area in Bogra. It has also been reported that millers in Bogra lend rice to poor peasants (see below):

In Bogra, the miller lends rice to poor peasants (during April, the major agricultural lean season) at a price of Tk. 800 to Tk. 900 higher than the market price per sack of rice (90 kg). This loan is repaid at harvest (in May-June) when prices are depressed. (Interview of a poor peasant)

The various types of tied transactions have been well-documented in the literature on paddy-rice markets but are certainly not restricted to that market alone (Crow and Murshid 1994). The objective of tying loans is to improve the returns of one party (the dominant or lending party) at the expense of the other, or to transfer

risk, in the context of a given transaction. The main forms of these tying loans are given below:

- Dhanerupore: where cash is advanced to peasants by trading intermediaries before harvest to be repaid partly in cash (usually the principal) and in kind (interest) at harvest at an agreed (higher than market) rate.
- Trader-dadon: working capital advanced in cash by higher-order traders to a subordinate trader (typically by an aratdar to a bepari) on the condition that the sub-ordinate trader must trade exclusively with the higher-order trader until such time as the advance is repaid.
- Credit in kind advanced by surplus peasants to traders, processors or other peasants to be repaid in cash at the highest price of the season.
- Short-term paikaribaki (sale credit) amongst traders that serves to promote client loyalty.
- Loans in kind from shop-keepers, millers or rich peasants to poor peasants to be repaid in kind or cash.

With the exception of paikari-baki, a rate of interest is implicitly charged in all tying transactions (Tables 4.2 and 4.3).

Tied exchanges allow the dominant party to by-pass the market and derive superior terms. However, tied exchanges are also risky as there is an incentive for borrowers (the weaker party) to renege if possible. This is essentially the principal-agent problem faced by the lender who is often located at some distance from the peasant. Contracts are verbal with no legal cover. Thus, for exchanges like dhaner upore to be credibly

conducted, a local agent is essential. This agent takes on the risk of exchange on behalf of his principal (absentee landlord or big merchant) and in exchange takes a cut from the profits. The local agent is well-informed about credit risks, and is someone with enough clout in the local community to ensure repayment.

TABLE 4.2

DIFFERENT TYPES OF FINANCIAL RELATIONS IN THE BACKWARD AREA PADDY MARKET

Type	Parties	Amount (Tk.)	Terms (implicit rate of interest)
Dhaner Upore ("money on paddy")	Sub-Trader to poor peasant	Usually 1,000-3,000	Cash for paddy at harvest (100-180%). In recent years changed from repayment of cash (principal) and kind (interest)
Dadon	Big trader to small	15,000-100,000	All the small trader's procurement promised to the big
Advance Purchase	Trader to peasant	1,000-3,000	Cash loan for paddy at harvest (very high)
Paddy loans	Big grower to trader	1,000-50,000	Paddy loan repaid in cash at above market price

Source: Based on Crow and Murshid (1994) and survey data.

TABLE 4.3

CHANGES IN THE DHANER UPORE RATE OVER TIME

Year	Implicit *Dhaner Upore* price (Tk./md)	Market price (Tk./md)	% Loss to grower
2008	417	600	30
2000	182	215	15
1989	143	200	29
1975	83	115	28
1972	20	67	70
1953	10	13	23

Source: Based on Crow and Murshid (1994) and survey data.

The question then is what binds the local agent to the higher-order trader or lender? This relationship, it may be noted, is similar to dadon that binds superior traders with subordinate ones. The main glue is trust borne out of a history of successful repeated transactions bolstered by an element of threat: there is a clear market norm that a subordinate must trade only with his principal as long as he remains indebted to him. No other trader in a given market area will engage in any exchange with a tied trader. Clearly, the relevant information relating to different traders in a market and their tied subordinates or agents become public knowledge quite quickly. Under the circumstances, agents have little choice than to play by the rules, only able to break out of this norm through full repayment of loans or permanent relocation to a different market or occupation (which means that he will have to build up his relationships with a new set of traders from scratch —not an easy job). The principal is thus able to bring to bear a lot of pressure on his agents through a set of well-established rules and norms that evolved endogenously in the market. Trust can also be thought of as crucial social capital which actually substitutes for cash working capital in the form of credit provided by the principal.

Thus, a majority of peasants in the backward area were found to be tied to money-lenders and traders twenty years ago. Over time, this has declined, although it still persists, especially in the chars of Noakhali.[1] The hitherto subordinate traders and agents have now emerged as small, independent financiers at the local level. The ties with big traders and money-lenders have

[1] Growers in Char WAPDA in Noakhali reported that 80 per cent of peasants were indebted through tied arrangements, mainly dhaner upore loans at 1 maund (40 kg) per Tk.1,000 plus principal to be paid in cash.

become weakened in the face of a much improved situation with respect to availability of credit (due to NGOs and remittances) and the demise of monopoly power of big traders-moneylenders twenty years ago (Crow and Murshid 1994).[2]

In keeping with the general decline in tied exchange, trader dadon, which used to be widespread in commodity markets across Bangladesh twenty years ago, is no longer seen. Subordinate traders are no longer tied (e.g. to millers or aratdars) but engage in voluntary trade with their principals. Thus, one wonders how the dominant forms of trade ('free exchange') are structured and sustained, given the fact that dadon used to be a such a key mechanism adopted by major actors (millers, aratdars) to ensure supply at a low price.

From Tied Exchange to Free Exchange

The ideal market is generally thought of as an impersonal market, guided solely by market supply and demand, based on excellent information flows, low default, low risk and low transactions cost. Such a market system is upheld and sustained by norms, rules and laws that require little or no enforcement, and is generally supported by a high level of generalised trust (see Murshid 1997). In such a market, tied contracts are absent; there is no need to invest in individual trust-building relationships; parties abide by the terms of the contract; one-off exchange is just as credible as repeated exchange; and there are remedies for default or opportunism that are easy to execute.

In most market contexts, especially in developing countries, such an ideal is distant, almost unreal. In

[2] Both small traders and poor peasants in Noakhali have reported access to micro credit from a well-known NGO – ASA.

practice, most markets in the developing world are situated somewhere in between the two polar extremes – namely markets dominated by tied transactions as seen in certain backward areas and the "impersonal" markets thought to exist in developed economies. Thus, agricultural markets in Bangladesh, like in most developing countries, depend crucially on reputation, repeat transactions and reciprocity (e.g. see Schwab and Ostrom 2008 and Ostrom and Walker 2003). The key problem that new entrants to the market have to overcome is the problem of trust and credibility. This is not so relevant for petty, itinerant traders engaging in low volume, face-to-face cash transactions.

For higher order traders, this is the central problem that must be overcome in order to succeed. Without a certain level of trust, trade must be conducted entirely on cash—this is difficult. In most cases, larger, more complex transactions, and transactions over longer distances or time, cannot be executed face-to-face. Further, there are additional risks arising from quality, weight and timeliness of delivery, which together make trading hazardous. These therefore require third party involvement in the market in the shape of, for example, the aratdar or commission agent, who can be relied upon to bridge the information, reputation and trust gap. Thus, for the bepari or miller or paikar, the problem becomes much more tractable: there is no longer the need to establish direct links with a myriad of trading partners spread across the country; all that now needs to be done is to find an "honest" aratdar to deal with. Complex transactions in Bangladesh agricultural markets cannot be conceived of without an active role of the aratdar. The aratdar, who is much maligned by the media, politicians and in popular lore, is in fact the central pillar of the market place.

It should be evident that entry into the aratdari trade is not easy. First, there is the capital constraint that needs to be overcome, including working capital needs (ranging from 2 to 6 lakh taka). Second, the process of establishing a reputation for honesty and credibility is time consuming and difficult, and last of all, a network of trusted buyers and sellers will need to be created from scratch. Risks remain even in trusted relationships as the following quote reveals:

Sometimes farias get lower than the declared weight even from known persons with whom they trade regularly. Sometimes an aratdar or bepari takes an extra quantity of paddy by using tricks during the measurement. Though the farias understand what is going on, they remain quiet as these are known, respected people. Sometimes transactions take place on short term credit, and when dues are not paid on time, the faria is unable to purchase paddy in the next hat.

Thus traders prefer to trade within a quasi-closed network of trusted clients and agents despite occasional breaches in verbal contract related to weight, standard, quality or timeliness of delivery, or disagreement on prices, as new relationships entail significant transactions costs. Exit is easy from the trade but entry is not automatic.

4.3 Morphology of Transactions in the Paddy-Rice Market

Paddy Bepari

The paddy bepari engages in transactions with farias or growers (to procure supplies) and with millers or paddy aratdars for selling the same. Transactions with farias/growers are in cash; sometimes cash is paid in advance to ensure supply. In the latter case, the bepari

acts as an agent of a miller who has made cash available for on lending to farias or growers. In the case of cash transactions, the basic problem is to ensure weight, quality and timely delivery—typically conducted directly, face to face. Once cash advances and on lending is introduced, the transactions become more complex, requiring mechanisms to ensure that default does not occur at any point in the chain that connects the miller or aratdar with the bepari, faria and grower. The riskiness of this arrangement has meant that the principal-agent problem implied (e.g. between miller-bepari and bepari-grower) is not so easily solved. Thus, the dominant paddy procurement mechanism has become dualistic, linking growers to millers through (a) independent beparis, and (b) paddy aratdars, rather than through tied agents.

Paddy Aratdar

The paddy aratdar re-emerged in the late 1990s after a period of near extinction in the 1980s (Murshid and Rashid 2001). Millers and processors moved away from direct procurement through beparis and hired agents initially, preferring increasingly to rely on paddy aratdars. As the scale of milling operations expanded, it became economically viable for large millers to set up an independent supply chain using hired agents to gain from economies of scale. Today both chains co-exist for different segments of the market. The large millers procure directly (having invested in solving the agency problem), while smaller millers continue to rely on paddy aratdars. For them, direct procurement remains too risky. Thus, Murshid and Rashid (2001 p.7) reports:

> There has been massive investment in milling capacity over the last 10 years. In one of the markets examined (Dhupchachia in Bogra), the milling-

processing capacity increased from around 17,000 MT to 44,600 MT (i.e. by more than 150 per cent). Some 2,000 small processors used to operate in this market ten years ago. Today their numbers have come down to 50. There used to be over 200 kandabeparis (micro-processors)—these no longer exist. Bullock cart owners used to be engaged in this trade also acting as local buyers and sellers - their numbers have come down from around 1,000 to less than 30 today. On the other hand, the cycle bepari and paddy aratdar have now emerged as principal actors in the paddy market. The number of cycle beparis has increased from around 100 to over 5000 while the number of paddy aratdars has increased from 5 to 35.

Rice Millers

Millers buy paddy and sell rice both in cash and on credit. Most of the transaction is done on credit, especially when business agents live in distant areas. Cash transaction is 10 per cent, transaction through cheques is 60 per cent and on credit 30 per cent. If transactions are in cash, a discount of Tk.5-10 is given to the buyer per maund (40 kg). Transactions made on credit are settled within 7 days, a facility given to some aratdars who are regular clients. Problems of exchange that remain include supply of low quality paddy, delay in repayment, loss due to default by agents, etc. Rice (unlike paddy) is always sold through rice aratdars. As *aratdars* bear the risk of transaction between millers and distant wholesalers, millers prefer this option to direct sale.

Quality and weight are directly inspected by buyers but even then complaints persist. Poor quality and low weight is not due to lack of information but due to lack of bargaining power in the exchange.

Rice Aratdars

Rice aratdars mainly deal with millers and wholesalers, local retailers and other (distant) aratdars. Aratdars make phone calls to millers or his agents and fix the price through negotiation. In this way, rice aratdars confirm rice availability from different districts. Some of the buying traders of the aratdar are tied agents. Advance payments are also made by aratdars to millers for ensuring supply of rice. At least 50 per cent of money transaction is conducted through banks. In the case of transaction on credit, 2 to 7 days are required to settle dues. Commission is Tk. 4 (for cash) and Tk. 5 (for credit) per maund (40 kg).

The aratdar is mainly interested in turnover but to ensure this, he has to ensure that he is able to build up a trusted, loyal client base of suppliers and buyers. As part of his business strategy, trader-dadon used to be rampant 20 years ago but has now reduced to a trickle in all major markets in Bangladesh. Verbal contracts are now entered into with free (untied) traders who have the option of going elsewhere with his business if there is lack of trust. Thus, rice aratdars have to compete on the basis of the total quality of service provided to clients (including short-term credit, quality and weight). In practice, trading partners are loyal, even if there are minor breaches in contract as it is difficult and time consuming to build new trade relationships.

Rice Wholesalers

Wholesalers procure rice supplies from different surplus areas of the country such as Dinajpur, Pabna, Mymensingh, Kushtia, Naogaon and Bogra. Purchases are made from two sources: (i) directly from millers and (ii) from aratdars. There are no tied agents of wholesalers with the main strength of the business firmly resting on

his reputation: suppliers of rice (in the distant rice surplus regions) look for wholesalers who have a good reputation of regular payment and who offer a good price. It was common 20 years ago to keep a representative permanently posted in the supply region to ensure that the verbal contract was honoured (in terms of weight, quality, variety, etc). This practice has disappeared because of the easing of the supply situation (thereby reducing the rush to garner supply "at any cost") and the ability to maintain close contact over mobile phones with potential suppliers. Risks for wholesalers have reduced over time but still remain significant.

Initially, the aratdar went himself to the procurement area to establish business links with an aratdar. Subsequently orders were placed through mobile phones after checking a sample sent and agreed, and payment made by telegraphic transfer (TT) through bank.

Another Noakhali rice wholesaler procures from rice mills through an aratdar situated in a major procurement area:

> "Most of our procurement is from Dhupchachia of Bogra. We have a taltobhai there who we call over phone when we need rice. He goes around different mills and checks the price and sends samples. Once we agree, the rice consignment is sent by truck. We make the payment through bank t/t only when we receive the consignment. The shipment is checked for quality as per sample sent and weight. In most cases, rice is sold without weighing. Actual weighing takes place if suspicion is aroused." (Interview with a wholesaler from Noakhali)

Most of the surveyed wholesalers in Dhaka have reported incurring losses due to default by trading

partners (retailers). Retailers sometimes do not make payment on time; sometimes they leave the business without making repayment, and thus cannot be traced. Credit sale is common leading to some losses and default every year. In other words, risks are predominantly on the selling or retailer end.

Suppliers have the sole responsibility of ensuring weight (measurement) and quality. While selling to retailers, wholesalers weigh every sack of rice. If the weight is less than what was declared by the supplier, payment will be adjusted accordingly. This adjustment is possible because full payment is not made immediately upon delivery but is staggered.

Rice Retailers

There are no tying arrangements but generally each retailer purchases from a few fixed wholesalers whom they trust and from whom they can purchase on credit. In Dhaka, business transaction is entirely on credit for purchase of rice from regular wholesalers living in or around the retail market. However, when rice is purchased from distant wholesalers located at some distance from the retail shop, only 30-40% can be purchased on credit, underscoring the increased problem of monitoring and risk associated with long distance trading.

Consumers

The other side of exchange, i.e. with consumers introduces some new problems (for consumers). Consumers are at a very clear disadvantage in Bangladesh markets. Consumer protection laws are virtually non-existent and where legal provisions exist, e.g. relating to adulteration of food, these are rarely enforced. The most crucial problem for consumers is the

highly asymmetric nature of information between retailers and consumers, given lack of standards and information relating to quality and price. The consumer therefore attempts to wade through the problem of poor information through hard-bargaining, a mechanism generally welcome in traditional markets. Rarely, however, is the consumer a winner because the informational advantage of retailers is simply too great. In the case of perishable goods where there is an urgency to sell quickly, a clever consumer could come away with a good bargain.

The large retail margin (compared to the wholesale margin) in various kitchen markets in urban areas has recently come in for comment and consternation in the popular mind and a belief that prices were being manipulated by a coterie of powerful traders. However, the large differential is better explained by the information asymmetry between consumers and retailers, relative to asymmetry that is likely to exist between, for example retailers and wholesalers. In addition, retail markets generally see one-off transactions between unknown agents where "snatch" (opportunistic behaviour) is much more likely, as it is easier to cheat a consumer and get away with it. Where the consumer is able to establish trust relationships through repeated transactions, the terms of transaction/quality of goods traded would be appreciably better. The retail trade is yet to develop into a large, modern operation where reputation-effects could come into play to reduce opportunism. A small beginning has been made in the capital city (Dhaka) where a few supermarkets have emerged on the scene. Until this trend becomes much larger, the retailer will continue to remain the weakest link in the chain presenting higher risks both to wholesalers and consumers, but particularly to the latter.

Bangladesh agricultural markets, as illustrated by the paddy-rice market, have become freer over time, having discarded many of the most severe forms of trade tying that used to be rampant in the trading system. In other cases, while tying continues to exist, its use as a major trading strategy has declined considerably.

The market today has discarded the most exploitative forms of tied trade but remains embedded in a web of personal relationships that each trader has painstakingly generated and carefully nurtures. It is these relationships that are central to the success of a trader; this is even more important than finance and capital. Without this type of "social-trade capital" exchange can only occur through cash and direct inspection and measurement of goods, obviating more complex and more sophisticated forms of transactions. Thus credible transactions are a direct product of social-trade capital with individual contracts carefully crafted to minimise risk and opportunism.

The most important problem that the market or traders have to resolve is therefore the problem of establishing appropriate social-trade networks. While all traders have to face this challenge to a greater or lesser extent, it is most important for the aratdar. The *aratdar* has to build links with buyers and sellers, establish a reputation for fairness and honesty, have sufficient market clout to provide credit and ensure repayment and generally honour a myriad of contracts with a diverse clientele. This takes time. Many fail in the process and leave the trade typically because trading partners have defaulted. No cases have been observed where the *aratdar* has entered into the trade directly. Very often, there is a long history of trade in the market beginning from humble origins as a faria or bepari, slowly accumulating capital, knowledge and, more

crucially, the all important social-trade capital, before finally taking the plunge into the aratdari business, changing from an itinerant trader into the more respectable position of a senior trader operating from fixed premises.

4.4 Generating Social-Trade Capital

How difficult is it to establish trust between potential trading partners in a market? This is not a problem in the local village market where everyone knows everyone and, at any rate, where transactions are face-to-face and direct. In larger markets or in long-distance trade, this is crucial. For want of a better construct, one would like to invoke cultural norms in the market as playing a crucial role. Typical entry mechanisms are as follows:

Introduction: Those who are lucky will have the advantage of being introduced or referred to by a senior, more established trader. This serves as a good entry point, enabling the new entrant to gain a foothold on the lowest rung of the ladder;

"*We are related*": A host of quasi kinship relationships are sought to be established with potential (new) trading partners. Thus, the first task is to find common ground in terms of location of permanent residence (e.g. village, thana, upazila or even district). Then, depending on the socio-economic position of the traders, they will refer to each other as big brother, brother-in law (dulabhai), dharmerbhai or taltobhai, and mamu (uncle). In addition, often instant rapport can be built through the use of regional dialect (especially, Noakhali, Sylheti and Chittagonian).

The moot point really is that the larger cultural-market context allows close pseudo-kinship relation-ships to emerge quite quickly, and from there, once

initial transactions are successfully conducted, the stage is set for repeated transactions followed by more complex, sophisticated contracts.

4.5 Supporting Credible Exchange: Focus on Markets

Market-wide norms, rules and institutions support credible, low cost exchange. These relate to mechanisms for grievance resolution, safety and security of transactions, acting as a clearing house for key information, e.g. on prices, reputation and status of traders, dealing with the police and "authorities", provision of credit, etc. In addition, credible exchange is facilitated by financial access and financing arrangements, insurance mechanisms, transport infrastructure, telecommunications and labour markets. Market associations and societies are, thus, an important market institution that deserves to be examined carefully.

Associations and Societies

Market associations are legal bodies representing all traders operating in the market and paying a regular subscription. Association specific to a particular commodity or category of trader is not common.

Associations usually have an elected body of office bearers, including a President, Secretary and Treasurer. The association levies a subscription charge and in turn ensures cleanliness, safety and security in the market, and also helps to resolve disagreements and conflict between trading partners. A principal function is to attract long-distance beparis to the market and to ensure the safety of their persons and their money. Frequently, market associations build up a savings-credit fund from subscriptions which can be borrowed

by members at favourable terms. In general, the association will represent the collective and individual interest of its members—a function that larger, richer associations in the big urban markets are better able to discharge, compared to, for example, small markets in rural areas. In this connection, they need to have a good working relationship with the Police, key government officials, political party leaders and even local thugs and gangsters i.e. with all potential agents that are known to impose unofficial fees and charges on traders. This is a sensitive and extremely difficult area of work for the association. It is well-known that most markets are captive to organised thugs frequently linked to ruling parties, who must be paid protection money regularly.

An example from the potato transport market shows how risks and fees are handled:

> Each truck can carry 155 sacks, each sack carrying 85 to 90 kg potato. Any accidental cost is borne by the bepari. In the case of theft of products or losses during transportation, truck owners (or the drivers) bear the loss. The truck owner bears all costs related to tolls or other costs incurred en route (e.g. bribes to the police, contribution to the labour association). The amount of toll is 1200 taka per truck and bribe is 100-200 taka (very rare during the emergency but now beginning to re-appear; contributions to the workers association is Tk. 50-100. (Field Report from Bogra).

In some areas there are commodity-specific associations, especially for rice e.g. in Bogra. In addition to all the usual roles played by an association, the rice traders association works closely with the government to meet official rice procurement targets of the Food Ministry.

Informal Market Norms

Certain practices and norms appear to be widely in use in agricultural markets, essentially designed to reduce default and lower risk. All contracts are verbal in nature and therefore are not legally binding. However, verbal contracts are generally respected in the trade although every attempt is made to pattern individual contracts in such a way as to ensure adherence, as has been noted earlier. For example, much of the reputation of a trader in a market is based on whether he honours verbal contracts. One should note that major religions, especially Islam considers a verbal contract to be as sacrosanct as a written one, so that when a religious person gives his "word" that is very unlikely to be broken. It is therefore no surprise that many large traders and aratdars adopt the garb of a pious man signalling loudly that he can be trusted.

An abiding market norm is that a (subordinate) trader who has taken a loan from a principal trader must route all his business through the latter. This information seems to become commonly known in the market so that all other traders will generally refuse to deal with the borrower till such time as he has paid off his loan and becomes an independent agent. The interesting point is to note that (a) information becomes quickly available, spreading through word of mouth – suggesting close informal networking among traders, and (b) collective action is generated as a result to control "deviant behaviour."

A majority of transactions, especially larger ones, contain an element of short-term credit, with these being liquidated and fresh credit taken during the next repeated round. Thus, at any given time, large traders and aratdars have a substantial amount of credit

outstanding. The norm of halkhata (new book of accounts) has evolved to resolve this problem. Thus, during every Bengali New Year's Day (1 Baishakh or 14 April), big traders organise parties where all trading partners are expected to come and settle all accounts. Those who fail to do so after a couple of such opportunities are then considered defaulters, and their names are deleted from the khata. While this does not ensure 100 per cent repayment, it is an important loan recovery institution in the market.

Traders appear to have a fixed set of partners with whom they enter into contracts, with or without (tying) loans to act as an inducement. The use of such loans depends largely on the supply-demand situation. If supplies are scarce, an attempt will be made to corner supply through various kinds of "encouragements." On the other hand, if demand is slow, there is an incentive to offer generous credit terms to buyers. The main pattern is that traders are loyal to each other. This seems to have become a norm in the market, based on experience that it takes time and patience to build new trade relationships, so that once established, people are reluctant to let it go, even if there are short-term problems faced once in a while (e.g. weight or quality problems in some transactions).

Some local norms have also been reported, e.g. from the potato trade in Bogra. In some areas there is a tradition that any cheating in terms of weight needs to be settled by giving the affected party double of the amount cheated. This was reported in transactions between growers and faria in Bogra.

Apart from market norms, exchange in agricultural markets requires support from a number of other facilitating markets, especially the financial market, the

labour and transport market, technology and information services, and the legal system. These are briefly discussed below.

Supporting Markets and Institutions

The Financial System

Penetration of the formal financial system in agricultural markets is limited. Some aratdars and wholesalers are able to borrow from banks, as are millers and cold storage owners. In addition, micro credit availability has expanded enormously all over Bangladesh but is available only to poor traders and growers. The informal financial market continues to play a significant role in financial intermediation in rural areas. However, as far as the trading system is concerned, much of the financing is endogenous, emanating from large traders and aratdars providing credit to subordinate traders and clients. Over the last 20 years, credit availability and access has improved, leading to a sharp decline in tied credit. Further, there is wide variation of terms. Formal sector credit to finance trade remains confined to the big traders, and generally to those with fixed premises and able to provide collateral. As the vast majority of traders involved are itinerant in nature, formal credit is denied to them.

Apart from credit, the financial system is used for payment, especially to long distance clients. The most common method is payment by TT (telegraphic transfer) and cheques which prevents abuse and possible theft. This has become possible because of the proliferation of bank branches across the country.

The Labour and Transport Market

The labour and truck transport market supporting agricultural commodity markets appear to be well-

organised and controlled by a few operators (styled as samitis). It is difficult for non-samiti labour or transport operators to enter a given market. Traders usually have to deal with a dalal or broker, especially when hiring a truck, and have no option but to pay set rates. Similarly, labour rates are set by their samitis.

Damage, accident or theft during transport is the responsibility of the operator although, in practice, this is often shared between the trader and operator on the basis of negotiations. Any charges, fees or bribes en route to the destination are the responsibility of the operator. Thus according to a field report from Bogra:

A single bepari or sometimes a group of beparis of the same locality hire one truck together to carry their products. Trucks are hired by contacting agents (dalal) of the local truck owner's samiti, who are paid 30 to 50 Taka commission per trip. Each truck can carry 100 maund brinjal. Any accidental cost is borne by the bepari. In the case of stealing of products or lost at the time of transportation, truck owner (or the driver) bears the losses. The truck owner bears all costs related to tolls or other cost on the way (e.g. bribes to the police and contributions to the labour association).

Technology

Twenty years ago there were few land-line telephones, few bank branches, few television sets and no cellular phones. Today cellular phones have spread to the furthest nook and corner of Bangladesh, and television sets are no longer the monopoly of a rich few. Thus, access to information is now literally at one's finger tips. In particular, the rise of cellular phone access has revolutionised markets, as traders are able to talk to clients and suppliers readily and able to place

orders over the phone. Once the order is carried out payment is made through banks. It is no longer necessary for traders to physically travel, for example, to the supply regions to check goods physically and organise transport, etc. All this has now been simplified and streamlined. This is a clear example of how technology has led to lower transactions costs.

4.6 Conclusions

Agricultural markets are apparently complex but basic exchange mechanisms are simple. The key institution in the market is the aratdari system, especially for (non face-to-face) stranger-transactions. All the three markets examined (rice, potato and brinjal) exhibit a local circuit and a long-distance circuit. In the case of paddy-rice, the local circuit is dominated by traditional micro-processors responding to local demand and tastes, and surviving through product differentiation. The longer circuit is dominated by modern rice millers catering to deficit areas and large, urban centres. The exchange modalities are similar but the scale and terms of exchange differ depending on nature of risks faced.

Trust-building and personalised transactions are keys to successful exchange relations but this is essentially endogenous to the transaction, requiring little or no external mechanisms. Once trust is built, repeated transactions dominate exchange – new partners are introduced slowly and gradually. There are some supportive norms and institutions like samitis along with loyalty inducing values including a reliance on contracts. The market culture is conducive to building trade rapport quite quickly and for quick, verbal dissemination of information, e.g. on reputation.

Formal legal institutions to enforce contract are non-existent; judicial recourse is not commonly available, as contracts are verbal. In terms of information, the weakest link is between consumers and retailers, as transactions are one-off, especially in urban centres, thus encouraging snatch (i.e. supply of sub-standard goods at a higher price). Only larger, institutional consumers (like restaurants), dealing with the same set of suppliers, can avoid this problem.

The market has become less tied and therefore more equitable. Bargaining power, however, remains an important price-fixing element in exchange that gives advantage to the superior party.

Policy

A major problem in the market is payment default and constitutes the single biggest threat to trading. This is handled endogenously by traders themselves or through informal interventions by the samiti. Traders who are able to develop appropriate strategies to keep this under control are able to survive. Payments are usually deferred (fully or partly) until a shipment is received. If the goods are considered sub-standard, further negotiations will be held (often over the phone) and some price discount will be agreed. Payment is then made through banks. The weaker parties are often unable to enforce a contract, so that some external mechanisms for conflict resolution would be useful in reducing risks. With the existence of national identity cards, this is now a real possibility.

Quality and weight issues are endemic problems in the trade arising from lack of grades and standards. This leads to a chaotic situation of local grading and sorting practices that can vary widely from place to place, and

which are difficult to assess. Traders will frequently mix a number of varieties (especially for rice) and try to pass it off as a superior quality. These problems are especially severe for unsuspecting consumers who have the least information available. Use of modern grading and sorting techniques and introduction of international standards should be closely examined.

The aratdari system is the central pillar for market exchange. *Policy attention needs to be focused closely on the aratdari system to improve it through modern management practices, use of ICT, quality management and product standardisation, access to bank credit—generally, trying to transform a "traditional" institution (in its mode of operations) to a modern, corporate entity, even if a relatively small one*. In order for this transformation to be successful, the scale of operations will need to be expanded so that unit costs can be kept to a minimum. Unless this transformation occurs from within, it may occur from without, with the intrusion of multinational and large national companies carefully eyeing the wholesale-retail sector.

The food trade sector is mired in problems of quality and standards, and concerns for bio-security. *Once again, the traditional trading sector must quickly address itself to these concerns if they are to remain competitive with the emerging modern sector*. While this competition is not yet evident, it is only a matter of time before it comes to ahead. While it may benefit some consumers, such a transformation will have serious repercussions on the poor, both traders and consumers. Thus, the transformation needs to occur quickly in the informal sector, with the aratdars best placed to lead this challenge. In its absence, a dual-track trading system

will emerge: one for the well-to-do, middle-class consumers led by large companies, and the other, much emaciated informal sector, catering to the poor.

CHAPTER 5

CONSUMPTION IMPACT AND ADJUSTMENTS AT THE MICRO LEVEL

5.1 Introduction

The impact of food price volatility on consumption, especially of the poor, is likely to be acute with survival often depending on complex adjustment processes. In general, the worst time for the poor is the pre-boro harvest period of March-April, which is usually associated with a seasonal food price peak. The pre-boro period of 2008 was particularly volatile, with rice prices rising to Tk.32-35 per kg (coarse variety) – an increase of 45 percent over the same period in 2007, leading to fears of deepening poverty and malnutrition. However, the bumper boro harvest of 2008 served to stabilise the situation. This chapter examines the adjustment process in the light of sharp food price volatility experienced in 2007-08.

A series of FGD exercises were conducted before and after boro 2008 to gather information on prices, wages, earnings, employment, etc. Comparisons were made between the situation before boro 2008 and the same period in 2007 and before and after boro 2008. In addition, a small household survey was conducted in two areas of Bangladesh—an agriculturally developed area (Bogra) and a backward area (Noakhali Chars).

Details of the FGDs

Two villages were chosen within 2-5 km of a village (primary) market, in each area.

A key person was chosen to facilitate FGDs (e.g. member, chairman, school teacher, etc.). Data were

collected on overall condition of these villages including number of households, infrastructure, schools, literacy rate, NGO presence, poverty rate, landlessness, migrants, seasonality, natural resources, etc.

Information on recent behaviour of rice and food prices was collected. The FGDs also focused on overall pattern of employment and wages, behaviour of crop and non-crop sectors, etc.

To understand the impacts of price hike FGDs tried to find out the most affected groups of people. It further explored how people responded to price change, food availability changes; how poor managed to survive; whether there was any asset sale, distress sale, distress borrowing; sacrifice of health and nutrition status, etc.

Details of the Household Survey

A survey was conducted on 200 households in two FGD villages each in Bogra and Noakhali, during October 2008. The survey covered rich, poor and very poor households. To understand economic status of various households in the selected villages, prior visits were made and assistance from local government members sought. Rich and poor households were identified on the basis of perception of the respective households regarding their economic status. Then sample households were chosen randomly from these rich and poor households. Data was collected on socio-economic characteristics along with wages, incomes, earnings, asset disposition and coping mechanisms.

5.2 Adjustments to Instability

The extent of food price instability experienced in 2007-08 is indicated in Table 5.1. Rice prices increased during the pre-boro lean season of 2008 over the same period in 2007, 30-45 per cent, depending on the

variety. Prices, however, fell back after the *boro* harvest in 2008, especially in the major rice producing areas. Thus, in Bogra, the rice price declined by around 12-15 per cent, serving to arrest what had appeared to be a situation of unbridled price escalation, which in turn dampened speculative behaviour. This decline, while welcomed at the time, seemed relatively small, given that a bumper harvest was reaped, and may be compared to the situation in 2009 when another bumper harvest of *boro* led to a sharp slump in rice prices, by over 30 percent compared to the same period in 2008.[1] Unlike in post-*boro* 2008 when the concern was with high prices, post-*boro* 2009 is faced with the spectre of very low farm gate prices that are barely able to cover farm production costs.

TABLE 5.1

WAGE-PRICE ADJUSTMENTS TO UNSTABLE PRICES IN BOGRA

	Pre-boro lean 2007	Pre-boro lean 2008	Post-boro 2008
Rice coarse	22	32	28
Rice fine	32	42	36
Wage Rate/day, male	62	80	110
Wage, kg equiv/day	2.8	2.5	3.9

Note: No boro is cultivated in the Noakhali survey village.

The concern with high-low prices stems from the twin policy goals of protecting the real incomes or consumption of the poor as well as the farming community. In the case of high prices, poor consumers have to adjust in order to be able to stabilise their already low food consumption levels. While it is generally noted that wages, especially rural wages, respond to food price rises, the moot question is how quickly this occurs

[1] It is highly likely that important influences are exerted by world market conditions even though Bangladesh is not heavily dependent on food imports.

and whether the response is sufficiently compensatory. It may be noted from Table 5.1 that real wages (in terms of rice) certainly adjust, and may even overcompensate for the initial real income loss, within a period of one year. As wage adjustments are not instantaneous, poor rural consumers need to find ways of coping in the short run.

The evidence from the Bogra FGDs point to a number of coping mechanisms displayed by the poor:

- Significant cut back in food consumption, especially rice consumption, and an attempt to substitute rice with cheaper foods.[2]
- High levels of indebtedness to mahajan and NGOs, as well as traders-shopkeepers
- Seasonal migration to urban areas for work
- Sale of non-land assets, especially poultry, animals and trees
- Forced into less desirable work for longer periods (especially for women).

Both in Dhaka slums and in rural areas, poor people were affected by rising food prices, with the direct impact falling on food consumption (as an example see box 1).

Box 5.1: Abdus Salam Mia, Age-68, Dhaka

In a 5 member family 2 are earning. He is dependent on the income of his two sons. As a result of heavy increase in price of food items, less rice is bought in his family. He cannot afford a little luxury of taking rice with milk and sugar, which he could afford before. His family cannot afford to buy fish and meat.

[2] Seasonal production of potatoes and leafy vegetables (shak) was in abundant supply during this period. It was widely observed during the fieldwork that poor peasants were heavily substituting rice with these foods.

Poor were also found to be taking loans from different NGOs and cooperative societies to meet daily needs. In rural areas poor people also sold livestock, household furniture, trees, etc. A few families in Noakhali even sold land to meet daily needs. Both in Dhaka and Noakhali, women and children suffered the most as a result of the price hike, because women were eating less and children were not fed nutritious food. Though urban wage rate was reported to remain unchanged even after price hike, some garment factory workers and security guards said their salaries were raised. Families with members working abroad fared relatively better, depending on increased remittances to tide over the bad times. However, family expenditures rose by at least 25 per cent. Urban house rents were also raised, inflicting greater hardships on the poor.

The household survey data provide additional evidence of adjustment processes. Some differences between the Bogra and Noakhali sample may be noted. The incidence of people described as very poor in Bogra was 14 per cent and in Noakhali 28 per cent, i.e. the Noakhali sample is poorer. It is interesting to note that the subjective categorisation of sample households into rich, poor and very poor in the two areas corresponds well in terms of income levels by category.

TABLE 5.2(A)

INCOME OF HOUSEHOLDS

Economic Status**	Number of sample households in different regions			Average annual income of the household group (in thousand Taka)		
	Bogra	Noakhali	Total	Bogra	Noakhali	Total
Rich	52	53	105	189.5	123.4	156.2
Poor	34	19	53	48.5	50.2	49.1
Very poor	14	28	42	43.6	37.7	39.7
Total	100	100	200		-	-

Note: "Economic status of the household is based on the perception of each household regarding their respective economic status.

TABLE 5.2(B)

AVERAGE LAND HOLDINGS OF HOUSEHOLDS

Economic Status**	Average total landholding by household group (in Decimal)			Average agricultural landholding by household group (in Decimal)		
	Bogra	Noakhali	Total	Bogra	Noakhali	Total
Rich	298.3	211.0	254.3	254.8	147.1	200.5
Poor	39.0	51.8	43.6	27.1	31.1	28.6
Very poor	6.8	29.7	22.0	2.0	15.1	10.8
Total	169.3	130.0	149.7	142.0	88.1	115.1

Note: "Economic status of the household is based on the perception of each household regarding their respective economic status.

In terms of landholding size, average holdings are larger in Bogra but, interestingly, the poor and the very poor in Noakhali have significantly more land than the corresponding groups in Bogra. It may be noted, however, that land in Noakhali is single cropped and of low yield.

Borrowing by households

It will be observed from Table 5.3 that indebtedness increased sharply in the face of rice price hike. In particular, borrowings from informal sources accelerated at a much faster pace. In particular, this tendency was seen to be heightened in the case of the poor and very poor households in Noakhali.

TABLE 5.3

NUMBER OF HOUSEHOLDS TAKING LOAN

Economic status of household	Number of households taking loan				% change between pre and price-hike periods	
	Price hike period		Pre- price hike period			
	Bogra	Noakhali	Bogra	Noakhali	Bogra	Noakhali
Rich	27	44	18	27	50.0	62.9
Poor	29	17	14	9	107.1	88.9
Very poor	11	23	11	10	0.0	130.0
Total	67	84	43	46	55.8	82.6

TABLE 5.4

BORROWING FROM DIFFERENT SOURCES

Survey region	Source of loan	% households taking loan during high price period			% households taking loan pre-high-price period (1 year before)			% change between the two periods		
		Rich	Poor	Very Poor	Rich	Poor	Very Poor	Rich	Poor	Very Poor
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Bogra	Govt.	42.30	14.7	28.6	33.3	9.70	19.0	9.0	5.0	9.6
	NGO	13.5	61.8	71.4	8.3	29.0	66.7	5.2	32.8	4.7
	Informal	9.6	29.4	7.1	2.1	6.5	4.8	7.5	22.9	2.3
Noakhali	Govt.	31.0	41.5	26.3	23.0	26.1	13.6	8.0	15.4	12.7
	NGO	38.0	39.6	57.9	27.0	26.1	31.8	11.0	13.5	26.1
	Informal	16.0	54.7	78.9	4.0	4.3	4.5	12.0	50.4	74.4
Total	Govt.	14.3	31.0	31.0	6.3	17.0	20.0	8.0	14.0	11.0
	NGO	32.1	41.0	39.5	25.0	27.0	27.0	7.1	14.0	12.5
	Informal	60.7	61.0	38.5	6.0	5.0	4.5	54.4	56.0	34.0

Decline in food consumption

Increase in food price increased household vulnerability by lowering consumption (Table 5.5). Overall, 88 per cent of "very poor" households were compelled to take less food than the amount usually demanded. Many households substituted cheaper food items; 38.1 per cent of very poor households and 28.3 per cent of poor households even faced near-starvation conditions, faced with no money and no food. Children of poor and very poor families reported missing meals.

TABLE 5.5

FOOD AVAILABILITY (AS PER CENT OF SURVEYED HOUSEHOLDS)

Economic status of household	Household taken low cost food (%)	Household taken less food than requirement (%)	Household facing a situation with no food and no money (%)	% household where children starved**	
				Part of a day	Whole day
Rich	1.0	15.2	2.9	none	none
Poor	9.4	67.9	28.3	2.4	2.4
Very poor	26.2	88.1	38.1	13.8	10.3
All	8.5	44.5	17.0	3.6	2.9

Note: **Based on only those households which have children of 12 years and below.

Decreased rice consumption and non-food expenses

An important indicator of the impact of food prices is the status of rice consumption by different households. As this is the staple food, households decrease their consumption only when all other options have been exhausted. While a sharp decline in rice consumption is observed among slightly larger percentage of people in Bogra than in Noakhali, a small decrease in rice consumption is much higher in Noakhali than in Bogra (Table 5.6).[3] Rich households in Bogra were found to be almost free from such adverse effects, but the situation is different for the rich in Noakhali, where 45 per cent of them marginally decreased their rice consumption. This indicates that scarce economic opportunities for generating additional income compel even those that are better off to adjust their rice consumption as food prices rise. Expenses on non-food consumption also decreased both in Bogra and Noakhali. One-third of the very poor households heavily decreased expenses for non food items (Table 5.7).

The sharp decline in non-rice food consumption has serious implications for nutritional status of the population.

[3] It was seen in the FGD that availability of rice substitutes in Bogra (potatoes and vegetable) was much higher compared to Noakhali.

TABLE 5.6

RICE CONSUMPTION IN DIFFERENT HOUSEHOLDS DURING HIGH FOOD PRICES

Region	Economic status of house-holds	Appreciably decreased (%)	Marginally decreased (%)	Not affected (%)	Not responded (%)	Total house-holds in a particular group
Bogra	Rich	0.0	1.9	98.1	0.0	52
	Poor	5.9	67.6	26.5	0.0	34
	Very Poor	28.6	71.4	0.0	0.0	14
	Total	6.0	34.0	60.0	0.0	100
Noakhali	Rich	0.0	45.3	52.8	1.9	53
	Poor	0.0	63.2	36.8	0.0	19
	Very Poor	14.0	75.0	10.7	0.0	28
	Total	4.0	57.0	38.0	1.0	100
Total	Rich	0.0	23.8	75.2	1.0	105
	Poor	3.8	66.0	30.2	0.0	53
	Very Poor	19.0	73.8	7.1	0.0	42
	Total	5.00	45.5	49.0	0.5	200

Source: Field Survey, 2010

TABLE 5.7

EXPENSES FOR COMMODITIES OTHER THAN FOOD

Region	Economic status of house-holds	Appreciably decreased (%)	Marginally decreased (%)	Not affected (%)	Not responded (%)	Total house-holds in a particular group
Bogra	Rich	1.9	38.5	59.6	0.0	52
	Poor	11.8	67.6	20.6	0.0	34
	Very Poor	35.7	64.3	0.00	0.0	14
	Total	10.0	52.0	38.0	0.0	100
Noakhali	Rich	7.5	49.1	41.5	1.9	53
	Poor	10.5	42.1	47.4	0.0	19
	Very Poor	32.1	60.7	7.1	0.0	28
	Total	15.0	51.0	33.0	1.0	100
Total	Rich	4.8	43.8	50.5	1.0	105
	Poor	11.3	58.5	30.2	0.0	53
	Very Poor	33.3	61.9	4.8	0.0	42
	Total	12.5	51.5	35.5	0.5	200

Source: Field Survey, 2010.

Additional work by households

During higher price of essentials people tend to work harder/longer in an attempt to stabilie real incomes. It was observed that additional work substantially increased among 38.1 per cent of very poor households (Table 5.8). Compared to Noakhali, more people of Bogra were found to be involved in additional work, reflecting the wider availability of employment opportunities than in Noakhali. It was also seen that additional work was undertaken by even poor women and children (Table 5.9).

TABLE 5.8

HOUSEHOLD INVOLVEMENT IN ADDITIONAL WORKS

Region	Economic status of house-holds	Appreciably decreased (%)	Marginally decreased (%)	Not affected (%)	Not responded (%)	Total house-holds in a particular group
Bogra	Rich	1.9	32.7	61.5	3.8	52
	Poor	26.5	35.3	32.4	5.9	34
	Very Poor	35.7	50.0	7.1	7.1	14
	Total	15.0	36.0	44.0	5.0	100
Noakhali	Rich	7.5	30.2	43.4	18.9	53
	Poor	10.5	10.5	63.2	15.8	19
	Very Poor	39.3	28.6	17.9	14.3	28
	Total	17.0	26.0	40.0	17.0	100
Total	Rich	4.8	31.4	52.4	11.4	105
	Poor	20.8	26.4	43.4	9.4	53
	Very Poor	38.1	35.7	14.3	11.9	42
	Total	16.0	31.0	42.0	11.0	200

TABLE 5.9

ADDITIONAL WORK BY WOMEN AND CHILDREN

Region	Economic status of house-holds	Appreciably decreased (%)	Marginally decreased (%)	Not affected (%)	Not responded (%)	Total house-holds in a particular group
Bogra	Rich	0.0	3.8	55.8	40.4	52
	Poor	2.9	2.9	55.9	38.2	34
	Very Poor	7.1	14.3	28.6	50.0	14
Noakhali	Rich	0.0	0.0	54.7	45.3	53
	Poor	5.3	0.0	63.2	31.6	19
	Very Poor	0.0	17.9	39.3	42.9	28
Total	Rich	0.0	1.9	55.2	42.9	105
	Poor	3.8	1.9	58.5	35.8	53
	Very Poor	2.4	16.7	35.7	45.2	42
	Total	1.5	5.0	52.0	41.5	200

Source: Field Survey, 2010

It may be noted that the poor households are adversely affected due to price volatility (Table 5.10). Of all the households, the very poor category appears to be hard hit by it as the overall economic conditions of two thirds of them were worsened. The overall economic conditions of about 40 per cent of the (moderate) poor category were also worsened. In contrast, 60 per cent of the rich households reported improvement of their economic wellbeing. Further investigation is needed to explain this apparent paradox.

TABLE 5.10
CHANGE IN OVERALL ECONOMIC CONDITION OF HOUSEHOLDS

Survey region	Economic status of households	Worsen (%)	Remained the same (%)	Improved (%)	Total house-holds in a particular group
Bogra	Rich	3.8	23.1	73.1	52
	Poor	44.1	26.5	29.4	34
	Very Poor	85.7	14.3	0.0	14
	Total	29.0	23.0	48.0	100
Noakhali	Rich	24.5	28.3	47.2	53
	Poor	31.6	36.8	31.6	19
	Very Poor	57.1	32.1	10.7	28
	Total	35.0	31.0	34.0	100
Total	Rich	14.3	25.7	60.0	105
	Poor	39.6	30.2	30.2	53
	Very Poor	66.7	26.2	7.1	42
	Total	32.0	27.0	41.0	200

Source: Field Survey, 2010

Post-Harvest Price Changes and Adjustments

The bumper rice harvest during boro 2008 had ushered in hopes that rice prices would fall quickly. Prices did decline, especially in the major production areas, but it was much less than was popularly expected. In fact, the farm gate price of rice remained largely unchanged between May and June 2008 while wages increased. The higher output increase per acre (by at least 20 per cent) generated a lot of demand for ancillary activities, creating employment, raising earnings and consumption. In other words, rice producing areas coped well with the highly unstable food/rice regime, as wages, employment and earnings adjusted to price volatility in Bogra.

This picture contrasts sharply with the deficit, mono-cropped areas of Noakhali. In the absence of a *boro* crop in the district, little change was seen in prices,

employment and consumption, although it could be argued that without a bumper harvest of *boro* nationally, the situation in Noakhali would have been even worse. The poor and even non-poor people were forced to adopt different adjustment measures:

- Seasonal migration increased sharply, with 1-2 members leaving the village from each household
- Credit i.e loans from usurious informal sources at adverse terms as well as from NGOs expanded rapidly (80 per cent of households have NGO loans, usually 2-3 loans per household).
- Advance crop sales were rampant along with traditional paddy-based credit like dhaner upore which involves credit in cash paid in paddy at harvest at a sharply reduced price.
- Sale of poultry almost universal.
- Deepened the hardships further as the September-October period (kartik) approached, as no employment was available even outside the village.
- Ten per cent of households sold land and went off to settle in the high-risk environment of newly emerging chars.
- Sweet potato was widely consumed as a cheaper rice substitute: most poor people ate one meal consisting of sweet potatoes. Many also mixed two kg of spinach with 1 kg of shak.
- Agricultural wages did not respond to higher prices as in Bogra.
- Demand for labour declined sharply; same with demand for consumer items, transport, etc (no one wanted to ride rickshaws to save money!).

- The aus crop harvested in July-August provides some respite in terms of creating some employment and stabilising local prices.

5.3 Conclusions

The main finding of this chapter is that price instability has a cost, and that poor households try to adjust through complex mechanisms. In surplus rice producing areas with a good boro harvest, these adjustments were easier as wages responded to high prices, the harvest itself stabilised rice prices while, at the same time, generating broad-based demand in the economy for a variety of trade, services and other employment. In non-green revolution, single crop areas like Noakhali (especially chars) the adjustment process was found to be much harder with the poor having to devise complex responses to stave off hunger. The main point is that for large parts of the country (i.e. where rice production is good), the problem of high prices is transitory with adjustments in the labour market and the overall economy occurring quite rapidly. The concern is with backward areas where micro-level adjustments are indeed costly, and where the local economy is unable to adjust so well. The policy implication is clear: it is important to design safety net programmes and development interventions especially for backward areas like chars, haors and lowland zones where the impact of high prices is severe.

CHAPTER 6

SOME KEY FINDINGS AND CONCLUDING REMARKS

Key Findings and Policy Implications

Production and Price Patterns

Price and production fluctuations have increased in recent years, and for rice, appears to be associated with large random and non-random shocks. The pattern of seasonality has remained unchanged with a twin-peak pattern in May and October. The October peak remains higher than the May peak. These findings point to the need for an active PFDS.[1]

Potato price seasonality off-sets rice price seasonality, while brinjal price seasonality accentuates it. This suggests that a policy of careful crop diversification can dampen food prices and help to smooth food consumption.

Domestic price-production relationship for rice seems weak, pointing to the likelihood that rice price is being increasingly influenced by external developments, e.g. in Indian and world food markets. This preliminary finding should be treated with caution as it requires further research to validate it, and suggests the need to systematically monitor and analyse Indian and world food markets in addition to monitoring of domestic production and price movements. A dedicated agency

[1] The findings in Chapter 3 found no role of PFDS in determining prices. The objective of PFDS operations is usually to stabilise prices, and, in particular, to regulate seasonal price hikes. This was not explicitly tested in the econometrics used in this chapter. Historically, OMS employed by the PFDS has played an important role in price stabilisation.

along the lines of an agricultural or food prices commission could be set up to address these objectives.

Spatial Market Integration

Overall markets, especially for potato and rice, are well integrated (LOP holds) although specific rice markets fared poorly while brinjal markets in general performed much less well. Thus, for some crops and areas, there is a need to improve market performance. In particular, perishable crops are likely to provide poor returns to growers as well as to small traders while the bigger traders and retailers appear to do much better. A positive impact could be had if it is possible to stagger output/harvests or to allow storage or processing of these goods. This would require appropriate public investments as well as agricultural research and extension.

Causality direction was found to be mixed. It was interesting to find bi-directional causality with Indian rice prices—this is difficult to explain given that Bangladesh imports from but does not export to India. It is possible, however, that there are significant informal flows of rice in both directions, especially from the border zones, that could explain this pattern. If price differentials are large, as may well happen during certain periods, such informal flows cannot be ruled out. This provides additional impetus to the need to carefully monitor food market trends in India at the disaggregated level.

Vertical Integration

The paddy growers appear to receive about 70 per cent of the retail value of rice. Both the paddy farias and beparis get about 8 per cent of the retail value. The paddy aratdars/wholesalers get about 4 per cent of the retail value. The low margins for the aratdars/

wholesalers can be explained by the fact that they are really commission agents. In the rice segment of the supply chain millers get around 7 per cent, and the rice aratdars/wholesalers get another 3 per cent of the retail value. The highest individual margins go to the rice retailers accruing about 9 per cent of the value.

For perishable items such as brinjal, the marketing margins are higher at the latter stages of the transaction. For instance, the marketing margins for wholesalers and retailers are more than double of that earned by farias and beparis. For this commodity, small volume offered by the farias and beparis makes their bargaining strength weak. For potato, the marketing margins do not follow any systematic pattern. When looked at the margins of potato vis-à-vis brinjal one may conclude that potato market is more efficient than that of the brinjal. In contrast, the marketing margins are higher for rice than potato or brinjal at almost all stages of transaction. While growers share in the final consumer price is less than 50 per cent for brinjal, it is about 70 per cent for potato and rice. While the shares of market operators are evenly distributed for potato and rice, it is highly concentrated among wholesalers and retailers for brinjal.

Market Institutions

Weaker parties are unable to enforce contracts, which calls for a strong need for external enforcement mechanisms. However, great care will be required as often formal mechanisms can end up having the exactly opposite effect than intended.

Use of modern grading and sorting techniques and introduction of international standards: This has been discussed often but no steps have yet been taken. This should be urgently addressed, especially if our target is to move towards agro-exports.

The aratdari system is the central pillar for market exchange. Policy attention needs to be focused closely on the aratdari system to improve it through modern management practices.

The food market is mired in problems of quality, standards, and concern for bio-security. This is a crucial challenge for the traditional trading sector, which, if left unaddressed, could mark the beginning of its end.

Consumption

For large parts of the country (i.e. advanced areas), the problem of high prices is transitory with adjustments in the labour market and the overall economy occurring quite rapidly.

This is not the case for backward areas where micro-level adjustments are costly, and where safety net programmes are urgently required.

Areas for Further Research

The price-production relationship for rice needs to be validated through more rigorous estimates.

There is a presumption that seasonality in food prices declined in the 1980s but may have become aggravated in more recent years. This needs to be verified as it has implications for PFDS operations.

The finding of bidirectional causality of Bangladeshi and Indian rice prices requires further investigation.

For rice, some areas appear not to be well integrated—these need to be identified and characterised. It is likely that these are the more backward, single-cropped areas.

The modern food retailing sector is in its infancy. The trade off between this sector and the traditional sector needs to be understood.

The single biggest threat to trading is default – its nature, extent and redressal mechanisms need to be examined in depth to identify remedies.

The aratdari system has been identified as the central pillar of the market. The task now is to promote this as a modern corporate entity. The question is how can this be done?

How to generate low cost consumer information that will reduce information asymmetry, especially at the interface with the retailer?

We also need to examine alternative shock-scenarios, the need for domestic stocks and costs compared to a strategy that depends more on a combination of stocks and imports to address food crises.

Some Final remarks

The study began with the question whether food insecurity has now re-emerged in Bangladesh, after a period of respite from the late 1990s to the mid-2000s. It was observed that over a thirty-year period, supply and price fluctuations in rice first declined in the 1990s but increased thereafter. It was also found that seasonality in rice prices is high with the major one occurring in September-October and a slightly smaller peak in March-April, suggesting that seasonal patterns have largely remained unchanged over the last two decades. At the same time, the world cereal, especially rice market, was found to exhibit sharp price movements, not entirely explained by the usual supply-demand movements. Indeed, a major price shock was experienced in 2007-08 in world food and energy prices, which, in turn, fuelled an intense period of high prices across the board. This was soon followed by the

recession in the wake of a slump in demand, bringing prices down to historical lows.

It is difficult to predict whether this combination of domestic and world market instability seen in recent years is a temporary phenomenon or would stay for a while. The dominant thinking on the subject seems to be that the world market will become increasingly unreliable as a source of imports of food, and that countries that depend on food imports need to carefully re-examine their options. Domestic markets are also widely viewed as being highly imperfect, leading to aberrant (high) prices and monopolistic control. The new reality seems to be that volatility has increased in both domestic and international markets, leading to a greater probability that this will heighten shocks – both positive and negative, more frequently than before. Thus, the problem of food management, which is already complex, is set to become even more difficult in the years ahead.

For a food-importing country like Bangladesh, the world market is given. Bangladesh can choose whether to participate but cannot dictate the terms of participation. There is, understandably, a huge pressure on the government to adopt autarkic policies for food. Indeed, the Awami League Manifesto explicitly states "Our main aim is to ensure 'food for all' by taking all possible measures and to make Bangladesh self-sufficient in food by 2013" (Election Manifesto of Bangladesh Awami League, 2008, p.9). These twin concerns regarding availability and access require that domestic production be scaled up and that access to food is ensured, not only on average, but in each and every time period. Given the greater probability of fluctuations and shocks in both the domestic and world markets, as well as the heightened risk of a combined world-domestic market shock, the task of food market

stabilisation assumes a greater challenge. This implies that the public food system hold huge stocks, undertake extensive procurement after harvest while also pursuing a policy of subsidised inputs to farmers to encourage production. In other words, one is staring at a set of policies that was thought to have become extinct in the 1980s and 1990s. Is this justified in the light of the emerging changes in the food price regime or is it a hasty reaction to traumatic food price movements seen in recent years?. Much depends on whether this type of volatility is seen as a temporary, one-off event or whether it is likely to be a permanent feature of the Bangladesh food regime.

Unfortunately, a reliable answer to this basic question is not easy to find. This is especially true for the world food market which is under pressure from a number of directions. Rapid growth in China and India has dramatically altered food consumption patterns with more calorie-dense foods like meat and poultry in demand. This has in turn intensified demand for feed grains. In addition, subsidies given to advanced country agriculture have made bio-fuels profitable which compete directly with human food. As far as developing countries like Bangladesh are concerned, volatility has increased possibly as a result of pushing cultivation to the more marginal areas, high and erratic behaviour in the availability of agricultural inputs including energy inputs, and diminishing returns to past investments in the now, not so new, agricultural technology. The probability of a joint external-internal shock to the food regime is therefore more likely today than ever before. As such, the government reaction seems apparently justified. However, further research is required to examine alternative shock-scenarios, the need for domestic stocks and costs compared to a strategy that

depends more on a combination of stocks and imports to address food crises. At the end, however, this will have to be based on the subjective judgement of policy makers.

Market performance was closely examined and in general found to be performing well. There was some evidence that the market for perishable items (in this case brinjal) was poorly integrated. It was also found that even in the case of rice markets, there were areas where markets were not well-integrated. Cross border rice markets were found to be well-integrated. Vertical integration was assessed through analysis of trading costs and margins for dominant types of transactions, and was generally found to be reasonable, although again, in the case of brinjal, the return to growers was relatively low. In other words, the study finds some evidence that for some markets and commodities, and in some areas, market performance is poor requiring appropriate policy action to be brought to bear.

Much of the domestic attention to a food crisis is on markets and traders who are frequently accused of collusion and price-fixing. This study finds no evidence for these concerns but does note that there is plenty of scope for improving market performance through reduction of certain types of risks and transactions costs. The central role of the aratdar working through a network of traders (who are increasingly free, not tied agents) was observed. Establishing trading networks is not cheap, taking time and credit arrangements to build. Such networks are crucial in resolving the problem of trust in an effort to lower risk and ensure turnover. Thus, the single most critical issue in trade is building reputation, trust and loyalty, generally through repeat transactions. These networks also enable small traders

to achieve a superior bargaining position against other larger entities than would have been possible if they were to trade directly, by-passing the aratdar.

The food security regime facing the country has changed possibly permanently. The outlook for the future is not good especially in the face of world market changes and the likely impact of global warming on Bangladesh agriculture. The attention of the government therefore needs to be on supply side factors, including provision of incentives for domestic producers. In this context, the cheap-food policy of the government needs a thorough examination. It would be important to have a longer term plan of allowing real food prices to rise gradually to ensuring farm incentives, raising rural incomes and purchasing power, and creating well-tuned safety nets for the ultra-poor. The supply side constraint also needs to be addressed by basic research.

The other side of the problem of food security is reflected in widespread malnutrition, especially child malnutrition, arising from a preponderance of rice in the national diet. Roughly between 75 and 80 per cent of calorie needs are fulfilled by rice or cereals causing a serious shortage in the intake of fat, fruits and vegetables. Ideally, not more than 55 per cent of calories should come from cereals, suggesting that longer term food policy needs to encourage consumption of non-rice foods. A medium term strategy of reducing cereal based calorie share to 60-65 per cent would be a reasonable goal, which, if achieved, will automatically ensure rice self-sufficiency due to reduction in rice demand (see Murshid *et al.* 2008). The thrust therefore must be on promoting the production and demand for fruits, vegetable and oil/fat in the national diet. The question is, how best can one move away from a rice-centred food policy to a more broad-based, nutritional approach? A

possible way forward is to borrow a leaf from the experience of the green revolution which was driven by technology, and initially, by heavily subsidised inputs. Unlike rice or other cereals, however, these other crops are likely to be much more perishable, requiring large-scale investments in appropriate infrastructure distribution and storage facilities. A pro-active public sector role in this context would be highly desirable.

Government of Bangladesh now seems to be going through a phase of drastic policy reversal. Even if one agrees with the rationale for increased state intervention in food and agriculture, the institutions and governance arrangements that are crucial in this context need to be strengthened. Many of these institutions have, over time, become emasculated (e.g. the public food distribution system) requiring capacity development, incentives as well as infrastructural improvements. A dramatic shift towards public interventions across the board could backfire with calamitous results if the underlying institutions are not corrected.

The four constructs in this study taken together provide a much more nuanced view of food markets that point not only to generally well performing markets underpinned by robust institutions but also to significant areas where improvements are required. This has now taken on some urgency as the supermarket revolution begins to make deeper inroads into what has been a traditional service sector. Food markets are thus at the cross roads where the confrontation between traditional but efficient structures and top-down, large-scale supply chains associated with modern retail will eventually have to fight fiercely in the battle of survival.

REFERENCES

Ahmed, N., Z. Bakht, P. A. Dorosh and Q. Shahabuddin .2007. "Distortions to Agricultural Incentives in Bangladesh." Working Paper 32, World Bank, Washington, D.C.

Ahmed, R. 2001. *Retrospects and Prospects of the Rice Economy of Bangladesh*. Dhaka: University Press Limited.

Ahmed, R. and A. Bernard. 1989. *Rice Price Fluctuation and an Approach to Price Stabilization in Bangladesh*. Research Report 72. International Food Policy Research Institute, Washington D.C.

Ahmed, R., S. Haggblade and T. E. Chowdhury (eds.).2000. *Out of the Shadow of Famine: Evolving Food Markets and Food Policy in Bangladesh.* Baltimore, MD: The Johns Hopkins University Press.

Alauddin, M. and C. Tisdell. 1991. *The Green Revolution and Economic Development*. London: Macmillan.

Baulch, B. 1997. "Transfer Costs, Spatial Arbitrage and Testing for Food Market Integration." *American Journal of Agricultural Economics*, 79(2):477-487.

Bollerslov, T. 1986. "Generalized Antoregressive Conditional Heteroskedasticity." *Journal of Econometrics*, 31(3): 307-327.

Camerer, C. 2003. *Behavioral Game Theory: Experiments in Strategic Interaction. Princeton.* , Princeton,N.J: Princeton University Press.

Chowdhury, N. 1992. "Rice Markets in Bangladesh: A Study in Structure, Conduct and Performance." Bangladesh Food Policy Project Manuscript 40, International Food Policy Research Institute: Washington D.C.

Chowdhury, N. N. Farid, and D. Roy (2008): Food Policy Liberalization in Bangladesh: How the Government and the Markets Delivered, MTID Discussion Paper no.92,

International Food Policy Research Institute, Washington D.C.

Colson, Elizabeth. 1974. "Tradition and Contract: The Problem of Order." London: Heinemann.

CPD. 2007. "Price of Daily Essentials: A Diagnostic Study of Recent Trends." Centre for Policy Dialogue, Bangladesh, mimeo.

Crawford, Sue and E. Ostrom. 2005. "A Grammar of Institutions." In Elinor Ostrom (ed.) *Understanding Institutional Diversity. pp.*137-174. Princeton, N.J.: Princeton University Press. Originally published in *American Political Science Review* 89 (3) (1995), pp.582-600.

Crow, B. and K.A.S. Murshid. 1989. "The Finance of Forced and Free Markets – Merchants' Capital in Bangladesh Grain Trade." DPP Working Paper, Open University, UK.

Crow, B. and K.A.S. Murshid. 1994. "Economic Returns to Social Power: Merchants' Finance and Interlinkage in the Grain Markets of Bangladesh." *World Development*, 22(7):1011-1030.

Das, J., S. Zohir and B. Baulch. 1997. "Spatial Integration of Foodgrain Markets in Bangladesh: Pricing Analysis." Bangladesh Institute of Development Studies, mimeo.

Dawson, P. J. and P.K. Dey. 2002. "Testing for the Law of One Price: Rice Market Integration in Bangladesh." *Journal of International Developmen*t, 14(4):473-484.

Del Ninno, C., P. A. Dorosh and L. C. Smith. 2003. "Public Policy, Food Markets, and Household Coping Strategies in Bangladesh: Avoiding a Food Security Crisis Following the 1998 Floods." *World Development*, 31(7): 121-1238.

Dickey, D.A. and W.A. Fuller. 1979. "Distributions of the Estimators for Autoregressive Time Series With a Unit Root." *Journal of the American Statistical Association*, 75(366): 427- 431.

Dorosh, P. and K.A.S. Murshid. 2000. "Trade Liberalization, Private Sector Imports and National Food Security in Bangladesh. FMRSP Synthesis Paper 2. IFPRI, Dhaka.

Dorosh, P. A., C. Del Ninno and Q. Shahabuddin. 2004. *The 1998 Floods and Beyond: Towards Comprehensive Food Security in Bangladesh*. Dhaka: IFPRI and UPL.

Engle, R. F. 1982. "Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation." *Econometrica*, 5o(4): 987-1007.

Goletti, F., R. Ahmed and N. Farid. 1995. "Structural Determinants of Rice Market Integration: The Case of Rice Markets in Bangladesh." *Developing Economies*, 33(2): 185-202.

Goodenough, Oliver and Monika Gruter Cheney. 2008. "Is Free Enterprise Values in Action." In Paul J. Zak (ed.) *Moral Markets: The Crucial Role of Values in the Economy*. Princeton and Oxford: Princeton University Press.

Hobbes, Thomas. [1651] (1960). *Leviathan, or the Matter, From the Power of a Commonwealth Ecclesiastical and Civil*. Oxford: Basil Blackwell.

Hossain, M. 1988. *Nature and Impact of the Green Revolution in Bangladesh.* Research Report 67. IFPRI, Washington, D.C.

Hossain, M., F. Nahar and Quazi Shahabuddin.2005. *Food Security and Nutrition in Bangladesh: Progress and Determinants,Vol.2*. Rome: FAO.

Johansen S. 1988. "Statistical Analysis of Cointegration Vectors." *Journal of Economic Dynamics and Control* ,12(2-3): 231–254.

————1992. "Determination of Cointegration Rank in the Presence of a Linear Trend." *Oxford Bulletin of Economics and Statistics,* 54(3):383–397.

Kwiatowski, D., P. C. B. Phillips, P. Schmidt and Y. Shin. 1992. "Testing the Null Hypothesis of Stationarity against the Alternative of a Unit Root: How Sure are We that Economic Time Series have a Unit Root?" *Journal of Econometrics,* 54(1-3): 159-178.

Moazzem, K. G. and K. Fujita. 2004. "The Potato Marketing System and its Changes in Bangladesh: From the Perspective of a Village Study in Comilla District." *Journal of Developing Economies*, 42(1): 63-94.

Mosconi, R, and C. Giannini. 1992. "Non-causality in Cointegrated Systems: Representation, Estimation and Testing." *Oxford Bulletin of Economics and Statistics,* 54(x): 399–417.

Murshid, K.A.S. 1986. "Nature, Levels and Trend in Instability in Foodgrain Production in Bangladesh." *Bangladesh Development Studies*, 14(2):33-73:

————1987. "Weather, Technology and Instability in Cereal Production in Bangladesh." *Bangladesh Development Studies*, 15(1): 31-56.

————1999. "Trade Liberalization and Food Security – the Evolution and Conduct of the Cross Border Trade in Rice (A Bangladesh Perspective)." Working paper, BIDS-IFPRI/FMRSP, Dhaka.

————1997. "Generalised Morality and the Problem of Transition to an Impersonal Exchange Regime—A Response to Platteau with Insights from the Bangladesh Rice Market." *Journal of Development Studies*, 33(5): 693-713.

Murshid, K.A.S. and Shahidur Rashid. 2001. "Market Transition and Price-Wage Dynamics: The Case of if the Bangladesh Rice Market." FMRSP Synthesis paper 5, BIDS-IFPRI, Dhaka.

Murshid, K.A.S., M. N.I. Khan, Q. Shahabuddin, M. Yunus, S. Akhter and O.H. Chowdhury. 2008. Determination of Food Availability and Consumption Patterns and Setting up of Nutritional Standard in Bangladesh. Dhaka: United Nations World Food Programme.

North, D. C. 1990. *Institutions, Institutional Change and Economic Performance,*.UK: Cambridge University Press.

O'Hara, E. A. 2008. "Trustworthiness and Contract" In Paul J. Zak (ed.) *Moral Markets: The Crucial Role of Values in the*

Economy. Princeton and Oxford: Princeton University Press.

Ostrom, E., and J. Walker. 2003. *Trust and Reciprocity: Interdisciplinary Lessons from Experimental Research*. New York: Russell Sage Foundation.

Ostrom, Elinor. 2005. *Understanding Institutional Diversity*. Princeton, N.J.: Princeton University Press.

Osmani, S.R. and M. A. Quasem. 1990. *Pricing and Subsidy Policies for Bangladesh Agriculture*. Research Monograph 11, BIDS.

Phillips, P.C.B. and P. Perron. 1988. "Testing for a Unit Root in Time Series Regressions." *Biometrika,* 75(2):335-346.

Pitt, M. M., S. R. Khandker, O. H. Chowdhury and D. L. Milimet.2003. "Credit Programs for the Poor and the Health Status of Children in Rural Bangladesh." *International Economic Review*, 44(1):87-118.

Pressman, S. and G. Summerfield. 2000. "The Economic Contributions of Amartya Sen." *Review of Political Economy*, 12(1): 89-113.

Rahman, S.H. (1993): Analysis of Agricultural Commodity Markets and Prices in Bangladesh." Bangladesh Institute of Development Studies, mimeo.

Ravallion, M. 1986. "Testing Market Integration. American Journal of Agricultural Economics, 68(1), pp. 102-109.

————1987. *Markets and Famines*. Oxford: Clarendon Press.

Razzaque, A., B. Khondker and S. Raihan. 2007. *Intrahousehold Distribution and Poverty Dynamics: Empirical Analysis on Bangladesh Data*. Dhaka: Bureau of Economic Research, University of Dhaka.

Reutlinger, A. 1986. "Securing Food Supply for All: Poverty and Hunger, Issues and Options for Food Security in Developing Countries." World Bank Policy Study, Washington, DC, USA.

Sally, D. 2002. "Two Economic Applications of Sympathy." *Journal of Law, Economics and Organization*, 18(2): 455-487.

Schwab, D. and E. Ostrom. 2008. "The Vital Role of Norms and Rules in Maintaining Open Public and Private Economics" In Paul J. Zak (ed.) *Moral Markets: The Crucial Role of Values in the Economy*. Princeton and Oxford: Princeton University Press.

Sen, B. and D. Hulme (eds.). 2006. *Chronic Poverty in Bangladesh, Tales of Ascent, Descent, Marginality and Persistence*. BIDS-CPRC.

Shahabuddin, Q and S. Mestelman and D. Feeny. 1986. "Peasant Behaviour Towards Risk and Socio-Economic and Structural Characteristics of Farm Households in Bangladesh." *Oxford Economic Papers*, 38(1): 122-130.

Shahabuddin and D. Butterfield. 1986. "The Impact of Risk in Agricultural Decisions: Tests of a Safety First Model in Bangladesh." *Bangladesh Development Studies*, 14(3): 13-37.

Shahabuddin, Q. and P. A. Dorosh. 2002. "Comparative Advantage in Bangladesh Crop Production. MTID Discussion Paper 47, IFPRI.

Timmer, C.P., W.R. Falcon and S. R. Pearson. 1983. *Food Policy Analysis—A World Bank Publication*. Baltimore and London: Johns Hopkins University Press.

Tomek, W.G. and K. Robinson. 2003. *Agricultural Product Prices*. Ithaca and London: Cornell University Press.

APPENDIX TO CHAPTER 3

TABLE A3.1

UNIT ROOT TESTS FOR WHOLESALE PRICES OF COARSE RICE ACROSS SOME DISTRICTS

Tests→	ADF Test		PP Test		KPSS Test	
Districts↓	Drift	Trend	Drift	Trend	Drift	Trend
Series in Level						
Barisal	0.440	-0.754	-4.595	-5.281	1.172	0.118
Bhola	0.728	-0.049	-5.441	-5.779	0.554	0.102
Chittagong	3.025	0.818	-4.436	-5.165	0.940	0.246
Comilla	1.365	-0.830	-4.556	-5.274	1.378	0.135
Dhaka	-5.926	-6.646	-5.954	-6.717	0.940	0.175
Jessore	1.406	-0.592	-5.070	-5.452	1.039	0.130
Khulna	0.949	-0.845	-4.573	-5.775	1.317	0.142
Manikganj	-0.352	-2.546	-5.237	-5.859	1.215	0.052
Moulavi Bazar	0.837	-1.634	-5.518	-6.528	1.253	0.136
Natore	2.684	1.017	-4.774	-5.787	1.021	0.213
Rajshahi	1.039	-0.680	-4.590	-4.725	1.199	0.162
Sylhet	-6.255	-8.139	-4.864	-5.135	1.139	0.069
Series in First Difference						
Barisal	-5.956	-6.062	-24.197	-22.918	0.101	0.084
Bhola	-11.703	-11.834	-18.772	-18.747	0.068	0.060
Chittagong	-10.541	-10.029	-15.719	-15.783	0.060	0.046
Comilla	-10.222	-10.501	-25.483	-24.208	0.124	0.100
Dhaka	-9.554	-9.854	-26.675	-26.774	0.065	0.065
Jessore	-6.139	-6.323	-20.152	-19.922	0.123	0.143
Khulna	-5.553	-5.783	-22.200	-22.209	0.167	0.135
Manikganj	-5.691	-5.776	-21.845	-24.649	0.073	0.070
Moulavi Bazar	-10.907	-11.151	-24.213	-21.862	0.065	0.049
Natore	-6.097	-10.942	-19.540	-19.487	0.052	0.051
Rajshahi	-6.150	-6.453	-15.674	-15.475	0.061	0.049
Sylhet	-9.575	-9.675	-15.445	-15.418	0.078	0.074

Source: Authors' estimates based on DAM data

TABLE A3.2

UNIT ROOT TESTS FOR WHOLESALE PRICES OF COARSE RICE ACROSS SOME DISTRICTS

Tests→	ADF Test		PP Test		KPSS Test	
Districts↓	Drift	Trend	Drift	Trend	Drift	Trend
Series in Level						
Barisal	-1.711	-2.805	-1.424	-2.724	0.865	0.196
Bhola	-1.426	-3.992	-2.000	-3.090	0.793	0.205
Bogra	-2.665	-3.646	-2.177	-3.394	0.845	0.214
Chittagong	-1.595	-2.630	-1.212	-2.335	0.830	0.193
Comilla	-1.325	-2.421	-1.973	-3.228	0.933	0.175
Dhaka	-2.036	-3.212	-2.119	-3.223	0.951	0.207
Khulna	-3.139	-4.304	-1.819	-2.959	0.849	0.183
Kushtia	-1.355	-4.313	-1.893	-3.083	0.886	0.224
Moulavi Bazar	-1.408	-2.299	-2.364	-3.239	0.761	0.166
Munshiganj	-2.306	-3.496	-2.243	-3.418	0.936	0.209
Rajshahi	-2.454	-3.592	-2.063	-3.541	0.901	0.220
Sylhet	-3.081	-4.285	-1.887	-2.952	0.861	0.183
Series in First Difference						
Barisal	-9.709	-9.743	-9.621	-10.586	0.300	0.185
Bhola	-10.051	-10.074	-12.409	-13.542	0.500	0.500
Bogra	-11.915	-11.894	-16.168	-17.703	0.281	0.162
Chittagong	-10.271	-10.296	-10.786	-11.789	0.302	0.124
Comilla	-10.406	-10.420	-14.778	-19.228	0.335	0.198
Dhaka	-11.072	-11.062	-14.894	-17.141	0.334	0.160
Khulna	-9.404	-4.687	-11.356	-12.039	0.257	0.185
Kushtia	-9.857	-9.877	-12.956	-15.289	0.324	0.323
Moulavi Bazar	-10.405	-10.426	-10.826	-11.872	0.368	0.230
Munshiganj	-10.106	-10.128	-17.657	-20.490	0.500	0.468
Rajshahi	-12.678	-12.660	-15.003	-15.908	0.220	0.098
Sylhet	-9.553	-9.565	-13.387	-18.816	0.328	0.159

Source: Authors' estimates based on DAM data

TABLE A3.3

UNIT ROOT TESTS FOR WHOLESALE PRICES OF COARSE RICE ACROSS SOME DISTRICTS

Tests→	ADF Test		PP Test		KPSS Test	
Districts↓	Drift	Trend	Drift	Trend	Drift	Trend
Series in Level						
Barisal	-1.453	-2.890	-1.068	-2.808	1.075	0.248
Chittagong	-0.376	-2.272	-0.172	-2.272	1.071	0.248
Dhaka	-1.185	-2.756	-0.392	-2.257	1.046	0.235
Feni	-1.217	-2.914	-0.453	-2.652	1.098	0.199
Khulna	-0.471	-3.176	-0.751	-2.705	0.982	0.242
Kolkata	-1.108	-2.608	-1.118	-0.945	0.664	0.100
Kushtia	-0.702	-2.509	-0.142	-2.509	1.019	0.227
Moulavi Bazar	-0.801	-2.357	-0.556	-2.429	1.091	0.196
Mymensingh	-0.920	-2.374	-0.177	-2.030	1.005	0.214
Naogaon	-0.501	-2.167	-0.539	-2.697	1.069	0.194
Patuakhali	-1.404	-3.060	-0.806	-2.649	1.090	0.220
Rajshahi	-0.595	-2.451	-0.125	-2.291	1.083	0.210
Sylhet	-0.509	-2.002	-0.109	-1.898	1.034	0.221
Series in First Difference						
Barisal	-12.468	-12.510	-13.274	-13.922	0.249	0.065
Chittagong	-12.330	-12.483	-12.348	-12.822	0.288	0.052
Dhaka	-14.906	-15.017	-15.707	-16.636	0.312	0.093
Feni	-14.281	-14.388	-15.078	-15.709	0.283	0.067
Khulna	-15.895	-16.059	-17.325	-18.279	0.436	0.067
Kolkata	-5.574	-5.587	-5.574	-5.587	0.213	0.182
Kushtia	-14.629	-14.851	-15.125	-15.694	0.460	0.072
Moulavi Bazar	-11.393	-11.450	-11.543	-11.838	0.225	0.054
Mymensingh	-13.726	-13.870	-14.302	-14.782	0.326	0.081
Naogaon	-15.644	-15.758	-16.466	-16.989	0.296	0.062
Patuakhali	-14.641	-14.756	-15.688	-17.867	0.345	0.116
Rajshahi	-13.671	-13.803	-13.900	-14.558	0.313	0.066
Sylhet	-12.421	-12.532	-12.599	-13.023	0.281	0.062

Source: Authors' estimates based on DAM data.