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and India: Implications for Food Security

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## ABSTRACT

This paper reports the survey findings that rice value chains are transforming in Bangladesh and India. The main elements of the transformation are as follows: First, rice value chains in both countries have begun to “geographically lengthen” and “intermedationally shorten.” Second, farmers capture about 60% of the final urban retail price of rice; this can be compared to about 23% in 1998 and 37% in 1980 in the United States. Third, the corollary is that about 40% of the value chain is formed by the postharvest segments of the rice value chain—in milling, trading, and retailing. Fourth, while much policy debate centers on direct government operations in food value chains, such operations were, in general, quite small in the rice value chain, except for the Government of India’s purchases from mills. Fifth, the indirect roles of governments have been important in enabling change and at times in providing incentives for transformation. Sixth, government subsidies had important effects, but the evidence of accessibility to subsidies and the impact of the services were mixed. Seventh, the study points to the importance of farm input supply chains upstream from farmers and of midstream and downstream postharvest activities such as logistics and wholesale, milling, and retailing. Policy implications are drawn in the final section of the paper.

**Keywords:** agriculture in Bangladesh, agriculture in India, rice value chain, stacked survey method

**JEL Classification:** Q12, Q13, O13



## I. INTRODUCTION

Spurred by the food crisis in 2008, governments and multilateral institutions in Asia called for an upgrading of the food value chains in the region. Data, however, were very limited on how domestic staples value chains were structured and performing. The Asian Development Bank (ADB) commissioned the International Food Policy Research Institute (IFPRI) to collaborate with research institutions in the region on a detailed study of rice and potato value chains. The study included a survey conducted in 2009–2010 with selected variables over 5–10 years. The study was conducted in six zones in Bangladesh, the People's Republic of China (PRC), and India, with one zone selected for each crop in each of the three economies. About 3,500 farmers, traders, millers, cold storage facility managers, and modern and traditional retailers were interviewed using structured questionnaires.

The results of the study are reported in the book, *The Quiet Revolution in Staple Food Value Chains in Asia: Enter the Dragon, the Elephant, and the Tiger*, which was jointly published by ADB and IFPRI in December 2012 (Reardon et al. 2012). The dragon refers to the PRC, the elephant to India, and the tiger to Bangladesh. All three are large economies with a powerful impact on the food economy of the emerging world. The study found that rice and potato value chains in each of the three economies were transforming, albeit at different speeds.

This paper summarizes the main findings concerning rice value chains in Bangladesh and India, and addresses three questions:

- Are rice value chains transforming structurally in Bangladesh and India?
- Is the conduct of rice value chain actors transforming?
- Is the performance of rice value chains enabling the inclusion of small-scale farmers, small-scale midstream actors, and workers, and resulting in lower food costs for consumers?

In addressing these questions, the paper focuses on (i) the domestic value chains that supply 98% of the rice and other staples in the region,<sup>1</sup> even as it acknowledges the importance of international trade; (ii) the market catchment areas within 8–10 hours of the capital cities of New Delhi and Dhaka, which are important to understanding the rural–urban rice value chains feeding the cities of South Asia, as urban areas constitute roughly two-thirds to three-quarters of food demand in the Asian region; (iii) private sector action in input supply, farming, processing, storing, trading, and retailing, since the private sector, both traditional and modern, is the most important direct actor in staple value chains in the region; (iv) the impact of policies and government market actions, such as buying output and selling inputs, on value chain transformation; and (v) the implications of the findings for domestic market development policies.

This paper further draws implications about the role of governments in facilitating desirable transformations. The paper notes the development strategies and policy paths that are

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<sup>1</sup> External rice trade was minimal in both rice economies studied, which were basically self-sufficient in rice. With some modest yearly fluctuations, about 2% of rice consumption in Bangladesh was imported in the 2000s. India exported on average 4.6% of its rice output during the crop years 2001–2002 to 2008–2009. India's rice imports had been negligible, less than 1% of total rice consumption in any year since 1990. That very little rice was externally traded by any of the economies studied justifies the focus on the domestic market as the rice value chain's end point.

likely to help economies further transform their staples value chains in order to pursue growth, reduce poverty, and enhance food security.

## II. SURVEY METHODS AND DATA

### A. Production Trends

Following is a brief summary of the survey methods and samples in Bangladesh and India as detailed in the report of Reardon et al. (2012).

First, “rapid reconnaissance” studies were done for rice value chains in Bangladesh and India. This consisted of interviews with representative types of actors in each segment of each value chain as well as academics, policy makers, and private sector associations. The literature pertaining to rice in each economy was also reviewed.

The survey data were eventually found to contradict many of the assertions of the key informants whom the study found to be simply repeating conventional wisdom and partial perceptions. One striking example is that, contrary to the report of many experts and key informants that “tied credit”—trader’s credit to a farmer in return for a guarantee that the farmer would provide the crop to the trader—was still very common, the surveys showed that it was actually very uncommon in the zones studied. Thus, the role of surveys in providing information essential for effective policy making cannot be understated.

Second, based on the broad picture emerging from the rapid reconnaissance studies, detailed structured questionnaires were formulated. These questionnaires were pretested and then modified about half a dozen times prior to the actual survey. They were then administered in surveys by enumerators who read the questions individually to respondents and noted the responses. No government officials or other people accompanied the interviewers, so no outside influence was introduced into the interviews.

Third, samples were tested in the rural and urban areas of each zone. This gave rise to a sample of about 1,125 farmers, traders, mills, and traditional and modern retailers in Bangladesh and India.<sup>2</sup> The study used a stratified random sampling method for every segment. The authors typically stratified by geographic area, using reasoned sampling based on the quantitative importance of the zone for supply to the capital cities, and villages and markets in the zones were selected based on their quantitative importance to supply. Then the authors sampled randomly within a given universe. In some cases, where there was a highly unequal set of actors, these were further stratified by category, such as smaller-scale and larger-scale farmers in the Indian and Bangladeshi rice areas. However, in the analysis, the shares of these groups were weighted in the population, as discerned by the study’s census of each area, so that the reported figures would be unbiased and representative.

The authors call the method the “stacked survey method,” as it entails a full sample survey at every level of the value chain, allowing the statistical study of differences across actor scales for each segment of the value chain. Each stage is represented by sets of actors, such as farmers, processors, and traders. Some of the surveys of specific segments were unique or had rarely been done, such as the surveys of postharvest segments, mills, traders, and

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<sup>2</sup> The details of the sampling methods and samples are presented in the Appendix.

especially of traditional retailers and supermarkets. No comparable survey-based study of rice value chains in Asia is evident in the literature.

The data were collected mainly in 2009 and the first half of 2010, using questionnaires that asked the interviewees to recall information over the year before the survey; for several key variables, a 5- or 10-year recall was also requested. But, in general, the survey's questions are for the year before the survey, and thus the viewpoint is mainly a snapshot of short-term change and cross-section comparisons.

The survey questionnaires asked the actors four categories of questions:

- i. characteristics of the actor, particularly the types of assets held—human capital such as education; social and organizational capital, including membership in associations and cooperatives; and physical capital such as holdings of equipment, land, and vehicles;
- ii. purchase of factor inputs (labor and external nonlabor inputs such as fertilizer and fuel) and intermediate inputs (such as the inventory bought by a trader), in terms of cost, geographic origin, supplier type, value-chain finance, quality attribute, and any contractual relation;
- iii. value addition using the inputs plus technology to produce outputs, such as the production of rice and potatoes, delivery and marketing of products, cold storage, and so on; and
- iv. marketing of the outputs, i.e., in terms of prices received, geographic destinations, and buyer types, as well as value-chain finance, quality attributes, contractual relations, and labeling/branding.

### **III. OVERVIEW OF CHANGES IN THE RICE VALUE CHAIN IN BANGLADESH AND INDIA**

In general, rice value chains can be grouped into four types, varying in terms of geographical length or the physical distance from farm to retailer, and by intermediational length or the number of steps from farm to retailer measured in the number of agents intermediating between them.

By way of comparison and identification of the current transformation underway, important works in the 1960s and 1970s such as that of Lele (1971) generally perceived traditional rice value chains as (i) geographically short, i.e., with a heavy component of subsistence and orientation to local rural markets; (ii) intermedationally long, i.e., with many “hands” or actors between farmers and consumers; (iii) highly fragmented and dominated by small-scale actors along each segment of the chain; (iv) characterized by the use of traditional technology and commercial practices; and (v) with a prevalence of tied credit-output market relations between farmers and village traders. This conventional image paints a picture of inefficient and static chains, forcing farmers into relations with few options, and consumers into purchasing from costly supply chains.

The study, however, found that changes in today's staple value chains are recasting this traditional image. The changes involve significant modernization in staples retail markets. These

changes signify a “quiet revolution” in traditional value chains in South Asia for two reasons. First, compared with the rise of modern supermarket chains, the avalanche of foreign direct investments in processing, and changes in world food trading systems that are transforming traditional staples chains tend to take place in the midstream, among traders, mills, and cold storage facilities. These midstream changes are like the more visible and debated downstream modernization in that they involve consolidation and technological and organizational changes in the segments. But beyond their location in the chain, they are unlike the modern food revolution in two ways: they are generally not spurred by foreign direct investments, and they generally involve investments by small and medium-sized midstream firms. Second, the midstream changes are “quiet” because they are grassroots in nature and are as yet generally unrecognized and their importance underappreciated, especially in policy circles.

The study’s overall findings are that rice value chains in Bangladesh and India are transforming rapidly, and that modernized or disintermediated value chains coexist with, while displacing, the traditional value chains.

In the zones studied—Noagoan to Dhaka in Bangladesh, and Shahjahanpur to New Delhi in India—the four types of rice value chains are as follows:

- i. The most traditional rice value chain, contained in the rural areas, is “geographically and intermedationally short,” and consists of the local supply chain of paddy grown by the farmer, which is dehusked in a local village mill, and consumed by the farm household or sold to the local village market for local consumption.
- ii. The rural–urban traditional rice value chain is “geographically long and intermedationally long,” and features the sale of paddy to local brokers or village traders, who sell it as paddy or have it milled in village mills, which in turn sell it to rural wholesale markets where it is bought by wholesalers from the cities. The rice is then sold to semi-wholesalers, who sell it to retailers, and/or to traditional retailers.
- iii. The intermediate (or transitional) rice value chain is “geographically long and intermedationally medium,” and entails the rice farmer selling paddy directly to mills. The mills then sell the rice to city wholesale market traders, or sell the paddy to rural or city wholesale market traders, who have it milled and then sell the rice in the city wholesale market. Traditional retailers buy the rice directly at the city wholesale market.
- iv. The modern rice value chain is “geographically long and intermedationally short,” with the farmer selling paddy directly to mills that sell the rice to supermarkets and/or urban wholesale markets, which sell to supermarkets and traditional urban retailers.

The surveys showed that in the Bangladesh study value chain (Noagoan to Dhaka), the rural–urban traditional value chain still dominated, but the transitional value chain was emerging quickly, with direct sales to mills. In India (Shahjahanpur to New Delhi), the transitional value chain strongly dominated, with the continued use of village traders and rural wholesale markets upstream, but with the direct sale from mills to urban traders downstream. The most traditional value chain no longer had a significant presence—in fact, it had a very minor presence—in both of the study zones.

#### IV. KEY FINDINGS ON THE TRANSFORMATION OF EACH SEGMENT OF THE RICE VALUE CHAINS

The study's key findings punch significant holes in the general view of Asia's staple farmers as traditional, and of input and output markets as underdeveloped and static. Instead, the findings paint a picture of change and development in rice farming and in the input and output markets that serve it. The key points are as follows.

##### A. The Rice Farm Segment

- i. Contrary to the prevailing image of Asian farmers on millions of tiny farms, farm sizes varied substantially, and there was evidence of land concentration—that is, in the larger farms—particularly in the western-central Uttar Pradesh zone. For example, across Uttar Pradesh, only 25% of the farms were medium- and large-scale, but they had about 66% of the land.
- ii. Moreover, land rental markets were developing rapidly in all three economies, but were most advanced in the Indian study zone of west-central Uttar Pradesh. In the latter, the rented land share was 26% in 2009 versus only 8% in 2004.
- iii. Within and across zones, farmers' possession of nonland assets, such as livestock, farm equipment, and irrigation, was substantially heterogeneous. Larger farms typically had more farm equipment (a substitute for labor) but somewhat less livestock, which is closely related to the livelihoods of the smaller, poor farmers who rely somewhat more on dairy.
- iv. In Bangladesh and India, the average holdings of farm traction machine assets—tractors, power tillers, and animal traction equipment—were similar per hectare (ha): the traction machine-land ratio in Bangladesh was about \$90 per 2.4 ha, or \$38 per ha, taking into account the two seasons, and in India, it was \$210 per 5.4 ha, or \$39 per ha. But over strata, the holdings differed a lot: the ratio (upper land stratum divided by lower land stratum) of machine holdings was 4.6:1 for Bangladesh and was very high for India, as no farms in the smallest stratum owned machines. However, the differences across farm size strata in terms of traction machine holdings mask an important point: while only a few farmers in the Bangladesh sample and about half of those in India owned tractors, power tillers, or animal traction equipment, nearly all farmers, regardless of size stratum, used farm traction machines. This points to a very well-developed market for farm machine rental in both economies.
- v. A surprising finding is that in Bangladesh and especially in India, tube-well owners (larger-scale farmers) sold a lot of water to small-scale farmers who did not own tube wells. Tube well ownership was especially skewed toward medium- and large-scale farmers in India, and so is the distribution of subsidies supporting that ownership.
- vi. Farmers were engaged in substantial amounts of rural nonfarm employment somewhat more in Bangladesh but especially in the India study zone. Local off-farm employment was far more common than migration for employment. That rural nonfarm employment was a major source of cash may help to explain why credit and output markets were no longer “tied” in these areas.

- vii. The study found very broad participation in seed, fertilizer, and pesticide and herbicide markets among the farmers in all the zones. In nearly all cases, the smallest-scale farmers were participating as fully as, and sometimes more than, the larger-scale farmers. It appears that the rapid rise in herbicide use is correlated with pressure on labor costs from the developing off-farm labor markets.

The state played a minor role in these markets in terms of direct sale of inputs, and only in a few areas: for rice seeds, the government was involved in 25% of farmer purchases in Bangladesh but in less than 5% of farmer purchases in India; for fertilizer, there was very little government involvement in Bangladesh but 28% in India. Importantly, the great majority of the subsidized fertilizer sales went to medium- and large-scale farmers, not marginal and small-scale farmers.

- viii. The study found an increased quality of rice output over the past decade in the study zones, especially in Bangladesh, marked by variety change and quality upgrading, and a rapid shift to medium from coarse grade rice in Bangladesh. However, the price premium for this higher quality represented a minor price differential for Bangladeshi rice farmers—while the differential was much greater in the midstream and downstream segments. This implies that the millers, wholesalers, and retailers captured the quality differential in the growing market for higher quality rice, while the farmers did not.
- ix. Rather than being mainly subsistence or even semi-subsistence farmers, the great majority of the farmers are small-scale commercial farmers. Farmers' marketed surplus rates were found to be high overall (above 80%–90%)—even the marginal and small-scale farmers in these zones were really small-scale commercial farmers, with staples as cash crops. Only the marginal farmers in Bangladesh had a substantial home consumption rate (43%), and thus could be termed semi-subsistence, but they still sold more than half their rice.
- x. The structure of local rice markets has changed a lot since the traditional situation painted by Lele (1971), where village traders were dominant and even seen as in monopsonistic competition. Rice value chains in most of the study zones appeared to be shifting from the traditional to an intermediate stage, with a decline in the role of the traditional rural middleman or village trader, and a rise in direct sales from farmers to mills and wholesale markets. This means an incipient disintermediation of the value chain. First, the study found that the role of the village trader had become minor, controlling only 7% of farms and sales in Bangladesh, and 38% of farms and 18% of sales in India. The marked difference between shares of farms and sales in India is because smaller-scale farmers tended to use village traders much more than the larger-scale farmers.<sup>3</sup> Second, the role of the wholesaler—mainly at the wholesale market but also in a minor way, at the mill—was becoming far greater by buying directly from the farmer: in both Bangladesh and India, farmers sold about 63% of their paddy directly to wholesalers. Third, incipiently in Bangladesh but not yet in India, farmers were bypassing middlemen and selling directly to mills. Of all paddy sold, 30% was sold directly to mills in Bangladesh, and 5% in India. The lower result in India is probably due to the Agricultural

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<sup>3</sup> Due to their small lots, the small-scale farmers sold to local traders who collected the produce, rather than having to deliver to the larger traders.

Produce Marketing Act that continues to be enforced in Uttar Pradesh, limiting market transformation.

- xi. Whereas the traditional literature on grain markets in South Asia emphasizes—rightly, in a historical context—the linkage between credit and output markets, in which traders “tie” output transactions to advancing credit to farmers, the study found that this is currently rare. Nonfarm incomes, mobile phones, multiple trading sites, better roads, and other forms of credit have undermined this tie over time. This implies that the traditional image of farmers tied to rapacious village traders—cum—moneylenders is now outmoded.

**Table 1: Farm Size and Nonland Assets, 2009**

| Asset  | Farm Size Strata (all arable and under any crop) |                         |         |
|--|--|-------------------------|---------|
|  | Marginal<br>( $<1$ ha)                           | Small<br>( $\leq 1$ ha) | All     |
| <b>Bangladesh</b>  |  |                         |         |
| Age of head of household (years)   | 47   | 51                      | 49      |
| Head of household (% male)   | 99   | 100                     | 100     |
| Household size (number of adults and children)   | 4.1  | 5.0                     | 4.5     |
| Household heads with no schooling (%)  | 25   | 15                      | 20      |
| Livestock holdings in 2009 (\$)  | 412  | 588                     | 500     |
| Farm assets other than livestock and land in 2009 (\$)   | 118  | 324                     | 221     |
| Mean value of power tiller owned in 2009 (\$; figures in parentheses show % of power tiller in total value of farm assets other than livestock and land) | 32 (28)  | 82 (25)                 | 57 (26) |
| Mean value of tractors owned in 2009 (\$; figures in parentheses show % of tractors in total value of farm assets other than livestock and land)         | 0  | 65 (20)                 | 33 (15) |
| Households owning power tillers (%)  | 2  | 4                       | 3       |
| Households owning tractors (%)   | 0  | 2                       | 1       |
| Households using machine traction e.g., tractors/power tillers (%)   | 92   | 94                      | 93      |
| Households using animal traction (%)   | 7  | 5                       | 6       |

*continued on next page*

Table 1 *continued*

| Asset   | Farm Size Strata (all arable and under any crop) |                                  |                             |          |
|---|--|----------------------------------|-----------------------------|----------|
|   | Marginal–<br>Small<br>(<2 ha)                    | Semi-<br>Medium<br>(≥2 ha <4 ha) | Medium–<br>Large<br>(≥4 ha) | All      |
| <b>India</b>  |  |                                  |                             |          |
| Age of head of household (years)  | 57   | 54                               | 55                          | 55       |
| Head of household (% male)  | 100  | 100                              | 100                         | 100      |
| Household size (number of adults and children)  | 8  | 8                                | 9                           | 8        |
| Household heads who are illiterate (%)  | 37   | 25                               | 22                          | 28       |
| Livestock holdings in 2009 (\$)   | 1,333  | 1,556                            | 1,556                       | 1,481    |
| Farm assets other than livestock and land in 2009 (\$)  | 222  | 667                              | 889                         | 592      |
| Mean value of tractors/tillers owned in 2009 (\$; figures in parentheses show % of tractor in total value of farm assets other than livestock and land) | 0  | 278 (42)                         | 353 (40)                    | 210 (36) |
| Households owning tractors (%)  | 0  | 45                               | 55                          | 50       |
| Households using machine traction e.g., tractors/power tillers (%)  | 88   | 83                               | 85                          | 86       |
| Households using animal traction (%)  | 12   | 16                               | 15                          | 14       |

ha = hectare.

Source: Authors' estimates.

**Table 2: Rice Farmers and Nonfarm Labor, 2009**  
(%)

| Labor                                | Farm Size           |                   |                             | All |
|--------------------------------------|---------------------|-------------------|-----------------------------|-----|
|                                      | Marginal<br>(<1 ha) | Small<br>(≤ 1 ha) | Medium–<br>Large<br>(≥4 ha) |     |
| <b>Bangladesh</b>                    |                     |                   |                             |     |
| Households with off-farm employment  | 12                  | 18                |                             | 15  |
| Households that received remittances | 5                   | 9                 |                             | 7   |
| <b>India</b>                         |                     |                   |                             |     |
| Households with off-farm employment  | 37                  | 38                | 36                          | 37  |
| Households that received remittances | 5                   | 7                 | 8                           | 7   |

ha = hectare.

Source: Authors' estimates.

**Table 3: The Shift to Higher Quality Rice**  
(% of average output)

| Rice Quality  | Year and Farm Size |      |                |      |      |      |      |      |
|---------------|--------------------|------|----------------|------|------|------|------|------|
|               | Bangladesh         |      |                |      |      |      |      |      |
|               | 1999               | 2009 | 1999           | 2009 | 1999 | 2009 | 1999 | 2009 |
|               | Marginal (<1 ha)   |      | Small (≤ 1 ha) |      | All  |      |      |      |
| Fine          | 20                 | 23   | 19             | 20   | 19   |      |      | 22   |
| Medium/common | 44                 | 63   | 46             | 62   | 45   |      |      | 62   |
| Coarse        | 37                 | 15   | 36             | 19   | 36   |      |      | 17   |
| Total         | 100                | 100  | 100            | 100  | 100  |      |      | 100  |

| Rice Quality | Year and Farm Size     |      |                           |      |                      |      |      |      |
|--------------|------------------------|------|---------------------------|------|----------------------|------|------|------|
|              | 1999                   | 2009 | 1999                      | 2009 | 1999                 | 2009 | 1999 | 2009 |
| India        | Marginal–Small (<2 ha) |      | Semi-Medium (≥2 ha <4 ha) |      | Medium–Large (≥4 ha) |      | All  |      |
| Common       | 96                     | 85   | 96                        | 86   | 96                   | 80   | 96   | 83   |
| Fine         | 4                      | 15   | 4                         | 14   | 5                    | 20   | 4    | 17   |
| Total        | 100                    | 100  | 100                       | 100  | 100                  | 100  | 100  | 100  |

ha = hectare.

Source: Authors' estimates.

**Table 4: Composition of Rice Farmers' Clients, 2009**  
(%)

| Buyer                            | Farm Size        |                |     |  |
|----------------------------------|------------------|----------------|-----|--|
|                                  | Marginal (<1 ha) | Small (≤ 1 ha) | All |  |
| <b>Bangladesh</b>                |                  |                |     |  |
| Village traders                  | 6                | 19             | 7   |  |
| Wholesalers on wholesale markets | 34               | 38             | 35  |  |
| Millers                          | 33               | 24             | 32  |  |
| Wholesalers at mill              | 33               | 29             | 32  |  |
| Others                           | 1                | 0              | 1   |  |

| India                            | Marginal–Small (<2 ha) | Semi-Medium (≥2 ha <4 ha) | Medium–Large (≥4 ha) | All |
|----------------------------------|------------------------|---------------------------|----------------------|-----|
| Village traders                  | 34                     | 33                        | 46                   | 38  |
| Wholesalers on wholesale markets | 59                     | 65                        | 67                   | 64  |
| Wholesalers at mill              | 8                      | 9                         | 12                   | 9   |
| Government agencies              | 4                      | 4                         | 9                    | 6   |
| Millers                          | 4                      | 7                         | 3                    | 5   |
| Other farmers                    | 6                      | 0                         | 3                    | 3   |

ha = hectare.

Source: Authors' estimates.

**B. The Midstream Segments (Mills and Domestic Traders)**

- i. There have been significant structural and organizational changes in the mill segment. Rice milling is becoming more concentrated in the medium and large-scale mills, with a rapid decline in small village mills, especially in India. Milling technology in both countries has also been changing toward semi-automatic and automatic mills. The improvements in the midstream segments of the rice value chain were largely private sector initiatives. Private milling and trading firms have made large investments in capacity expansion, new technology, logistics, and services to farmers. Yet the findings and the reasons behind them suggest that the government had played an important enabling role, as for example when the Indian government “de-reserved” the mill sector in 1998. Other measures directly facilitated change, such as major improvements in roads and other infrastructure in the last 10–15 years.
- ii. The survey showed evidence of disintermediation upstream, with the traditional role of the village trader being reduced as wholesale markets sourced paddy directly from farmers while mills increased direct sourcing from farmers. Moreover, disintermediation was also evident downstream, with mills selling directly to wholesale markets in the big cities.
- iii. The conduct of the rice value chain has been changing quickly, especially in Bangladesh where mills and wholesalers representing mills have begun selling branded, labeled bags to retailers. This has introduced traceability in the rice value chain.
- iv. Moreover, the traditional practice of traders providing advances to farmers in the form of “tied credit” has nearly disappeared in both Bangladesh and India. The change appears to be due to farmers’ improved options for selecting buyers and in accessing other means of credit and cash.
- v. The government has played only a small direct role as a rice supplier or a buyer from mills in Bangladesh. But in India, the government has remained a major player as a client of mills via the levy system. For instance, in Uttar Pradesh, mills are required to provide 60% of their rice output to the government; the study found they sold 59% of their output to the government.
- vi. Mill and especially trader profits were found to be fairly high, although in line with some prior research findings. The high profit rates can reflect the risky nature of the trading enterprise, and possibly some local market power. An outlier was the case of rice trading in New Delhi, with especially high profits. The high profits in general may have been related to the high investments required to engage in rice milling and trading. In particular instances, the profits may have been related to policies such as the market licensing and entry restrictions in India.

**Table 5: The Structure of the Rice Mill Segment, 2009**

| Mill Characteristics                          | Mill Type/Size |                           |                 |      |
|---|----------------|---------------------------|-----------------|------|
|   | Small          | Semi-Automatic/<br>Medium | Automatic/Large | All  |
| <b>Bangladesh</b>                             |                |                           |                 |      |
| Average start-up year                         | 1998           | 2000                      | 1998            | 1999 |
| Capacity in 2009 (tons/day)                   | 33             | 42                        | 73              | 51   |
| Capacity at start-up (tons/day)               | 22             | 21                        | 34              | 26   |
| Mill value in 2009 (\$ '000)                  | 10             | 650                       | 1,710           | 840  |
| <b>India</b>                                  |                |                           |                 |      |
| Average start-up year                         |                | 1995                      | 1995            | 1995 |
| Capacity, high season (tons/day)              |                | 100                       | 68              | 92   |
| Milling capacity (off-season)                 |                | 40                        | 27              | 37   |
| Capacity (high season) at start-up (tons/day) |                | 84                        | 64              | 78   |
| Mill value in 2009 (\$ '000)                  |                | 169                       | 127             | 149  |

Source: Authors' estimates.

**Table 6: Rice Mill Sales by Source and Mill Size, 2009**  
(averages in each stratum of shares of all rice sold by the mills, %)

| Buyer                              | Mill Type/Size |                           |                     |     |
|------------------------------------|----------------|---------------------------|---------------------|-----|
|                                    | Small          | Semi-Automatic/<br>Medium | Automatic/<br>Large | All |
| <b>Bangladesh</b>                  |                |                           |                     |     |
| Government                         | 11             | 7                         | 3                   | 7   |
| Village traders                    | 0              | 16                        | 6                   | 7   |
| Traders on rural wholesale markets | 77             | 44                        | 36                  | 53  |
| Traders on wholesale markets       | 11             | 29                        | 48                  | 30  |
| Traditional retailers              | 0              | 4                         | 6                   | 3   |
| Total                              | 100            | 100                       | 100                 | 100 |
| <b>India</b>                       |                |                           |                     |     |
| Government                         |                | 58                        | 60                  | 59  |
| Village traders                    |                | 17                        | 14                  | 16  |
| Traders on wholesale markets       |                | 24                        | 24                  | 24  |
| Traditional retailers              |                | 1                         | 2                   | 1   |
| Total                              |                | 100                       | 100                 | 100 |

Source: Authors' estimates.

**Table 7: Rice and Paddy Traders' Profits, 2009**  
(%)

| Season            | Village Traders | Rural Wholesalers | Urban Wholesalers |
|-------------------|-----------------|-------------------|-------------------|
| <b>Bangladesh</b> |                 |                   |                   |
| In-season         | 55              | 68                | 17                |
| Off-season        | 47              | 51                | 22                |
| <b>India</b>      |                 |                   |                   |
| In-season         | 45              | 40                | 77                |
| Off-season        | 28              | 38                | 75                |

Source: Authors' estimates.

### C. The Downstream Segment (Rice Retail)

- i. Traditional rice retail, as revealed by the detailed survey in South Asia, is somewhat different from the images and assumptions normally associated with it. Traditional rice retail has been evolving in ways that point toward greater quality differentiation, packaging, and brand development. The study showed that this has been initiated in Bangladesh but barely so in India, although this has been done earlier and more quickly in the PRC. Given these incipient changes, it is probable that mill and/or modern retail chain branding and the resulting traceability will be significant factors in the development of rice markets in urban Asia, and will probably also encourage continued consolidation in the mill and trading sectors. Further, the study found that traditional retailers provided very little value-chain finance by letting customers buy on credit, and tended to do little home delivery in Dhaka and New Delhi.
- ii. Modern retailing has started to penetrate rice markets in Dhaka, with less than 1% of the market, and in New Delhi, with about 7% of the urban rice market. The latter rate seems small, but is surprising given that about 80% of supermarket growth in New Delhi had occurred in just 3 years before the survey in 2009. While supermarkets in Dhaka still charged more for rice, supermarkets in New Delhi charged less than traditional retailers. Moreover, supermarkets sold a greater variety of rice to appeal to quality differentiation needs and consumers with increasing incomes.
- iii. The government had little direct role in rice retailing in Bangladesh, but in urban India, the government controlled about 15% of urban rice retail—about twice that of modern private retail. The government did not appear to have a comparative advantage in retailing rice. A large portion of Indian public stores were not open during business hours, corroborating findings about inefficiency and low consumer access to subsidized retail.
- iv. To date, foreign direct investment in retail has not played a significant role in Bangladesh and India. In India, this may start to change quickly with the liberalization of retail in September 2012 by the central government, which allows foreign direct investment in multibrand retail.

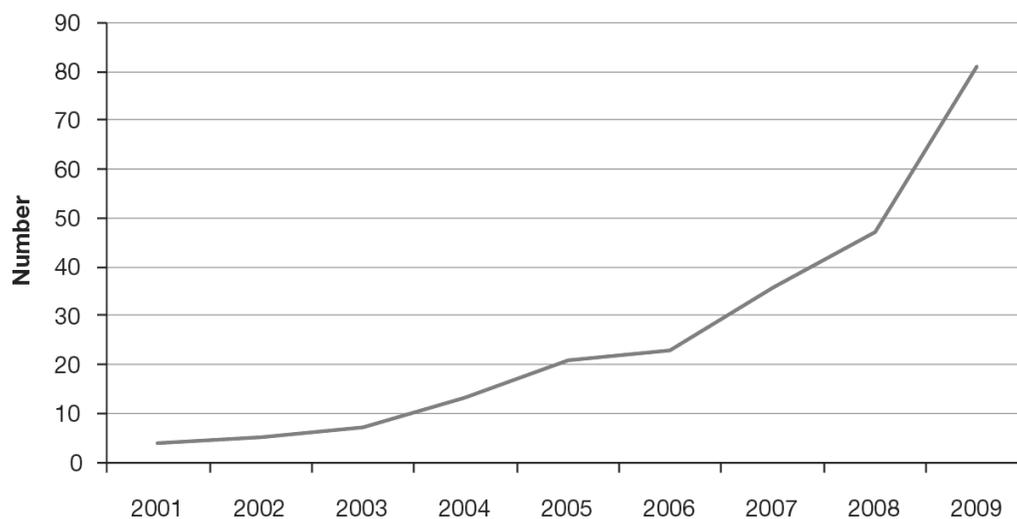
**Table 8: Traditional Rice Retailers' Credit with Suppliers and Customers and Home Delivery, 2009–2010**  
(%)

| <b>Credit Flows</b>   | <b>Dhaka,<br/>Bangladesh</b> | <b>Beijing,<br/>PRC</b> | <b>Delhi,<br/>India</b> |
|---|------------------------------|-------------------------|-------------------------|
| Suppliers paid by retailer with delay (on credit)                   | 85                           | 28                      | 49                      |
| Retailers that paid suppliers late (on credit)                      | ...                          | 14                      | 50                      |
| If credit was given, share of payment on credit                     | 39                           | 56                      | ...                     |
| Share of retailers giving credit to consumers (for delayed payment) | 69                           | 59                      | 77                      |
| Share of customers that bought rice on credit (paid later)          | 12                           | 17                      | 13                      |
| <b>Home Delivery</b>  | <b>Dhaka,<br/>Bangladesh</b> | <b>Beijing,<br/>PRC</b> | <b>Delhi,<br/>India</b> |
| Retailers that home-deliver   | 8                            | 92                      | 40                      |
| Consumers with home delivery from traditional rice retailers        | ...                          | 61                      | 10                      |

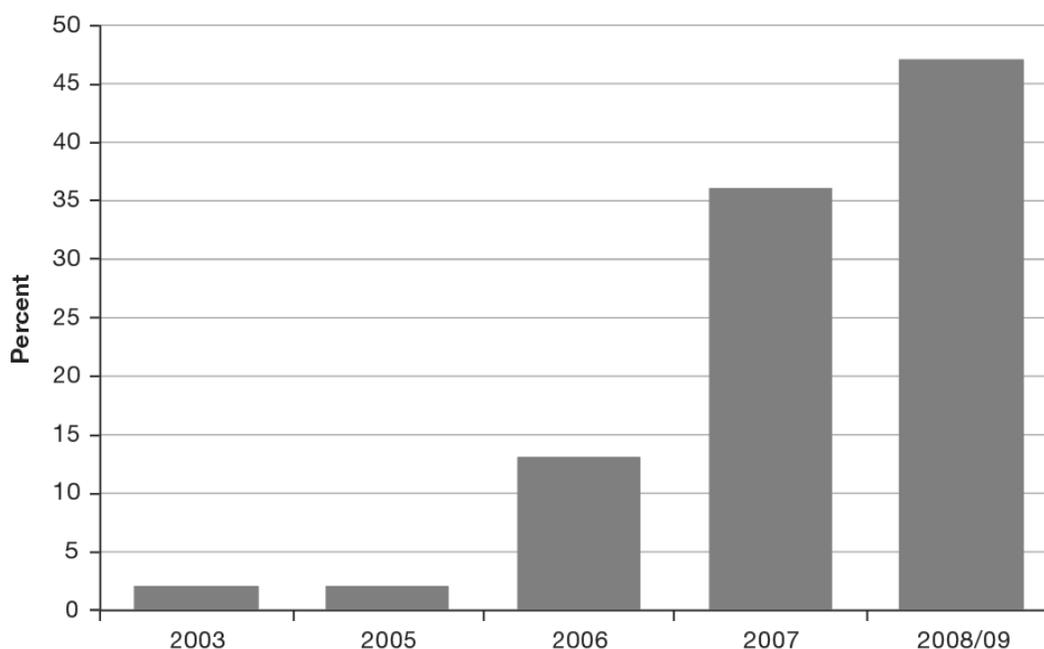
... = no data available, PRC = People's Republic of China.

Source: Authors' estimates.

**Figure 1: Number of Supermarket Stores in Dhaka, 2009**



Source: Authors' estimates.

**Figure 2: Start-up Years of Modern Retail in Delhi, 2009**

Source: Authors' estimates.

## V. KEY FINDINGS ON OVERVIEW OF MARGINS AND COSTS ALONG THE SEGMENTS OF THE RICE VALUE CHAIN

An overview of the distribution of costs and rewards in the rice value chains in Bangladesh and India, and the composition of the costs, highlight several salient points.

- i. Rice farmers in Bangladesh and India captured roughly two-thirds of the final or urban retail price in the rice value chain. That share varied by quality of rice. Farmers in Bangladesh least captured the differential between fine and common rice, and had a higher share in the value chain for common rice than for fine rice. The differential for the farmers in the India zone was very slight and the gains were shared fairly equally across the value chain segments in India.
- ii. Other than labor, the largest single component of rice value chain costs was farm-level external inputs, at roughly a third in both countries. Therefore, improving the efficiency with which inputs are delivered and used could have a significant effect on the rice value chain.

Hired labor was about a third of value chain costs in Bangladesh and India. Developments in the nonfarm labor market could put upward pressure on rice prices over time, unless both countries continue to mechanize their farms.

- iii. The share of the off-farm components in the total margins of the value chain was roughly 35% in both India and Bangladesh.

- iv. While market fees have figured mightily in food security debates, particularly in India, their impact on the rice value chains was slight, with less than 1% effect on the final price.
- v. Energy costs were important in the rice value chain, at the farm level in mechanization, and intensively so in the mill and trading segments of the two economies. Thus, energy shocks can translate into higher rice prices.
- vi. Transport costs as a share of rice prices were modest in Bangladesh and India mainly because the chains were relatively short. However, transport costs per ton per kilometer in the South Asian countries were twice as high as in the PRC.

**Table 9: Shares of Rewards, Costs, and Total Margins in the Rice Value Chain, 2009**

| <b>Bangladesh – from Noagoan District to Dhaka</b>  |                    |                 |                      |                  |                 |                      |
|---|--------------------|-----------------|----------------------|------------------|-----------------|----------------------|
|   | <b>Common Rice</b> |                 |                      | <b>Fine Rice</b> |                 |                      |
| Average retail price of rice in Dhaka (\$/ton)  | 444.23             |                 |                      | 634.60           |                 |                      |
| <b>Share of rewards, costs, and total margins accruing to (%)</b>   | <b>Rewards</b>     | <b>Costs</b>    | <b>Total Margins</b> | <b>Rewards</b>   | <b>Costs</b>    | <b>Total Margins</b> |
| Farmers (rice equivalent)   | 69                 | 87              | 79                   | 38               | 86              | 52                   |
| Rural paddy wholesalers (rice equivalent)   | 4                  | 1               | 2                    | 17               | 1               | 12                   |
| Millers   | 8                  | 3               | 5                    | 10               | 3               | 8                    |
| Urban rice wholesalers  | 10                 | 1               | 5                    | 5                | 1               | 4                    |
| Urban traditional retailers   | 9                  | 8               | 8                    | 30               | 8               | 24                   |
| <b>Total rewards, costs, and total margins in the value chain (figures in parentheses show the share of the Dhaka retail price)</b> | <b>100 (47)</b>    | <b>100 (53)</b> | <b>100 (100)</b>     | <b>100 (70)</b>  | <b>100 (30)</b> | <b>100 (100)</b>     |
| <b>India—from Shahjahanpur in Uttar Pradesh to Delhi</b>  |                    |                 |                      |                  |                 |                      |
|   | <b>Common Rice</b> |                 |                      | <b>Fine Rice</b> |                 |                      |
| Average retail price of rice in Delhi (\$/ton)  | 433.33             |                 |                      | 593.33           |                 |                      |

*continued on next page*

Table 9 *continued*

| <b>Share of rewards, costs, and total margins accruing to (%)</b>   | <b>Rewards</b>  | <b>Costs</b>    | <b>Total Margins</b> | <b>Rewards</b>  | <b>Costs</b>    | <b>Total Margins</b> |
|---|-----------------|-----------------|----------------------|-----------------|-----------------|----------------------|
| Farmers (rice equivalent)   | 69              | 63              | 66                   | 65              | 61              | 64                   |
| Rural paddy wholesalers (rice equivalent)   | 6               | 2               | 4                    | 6               | 4               | 5                    |
| Millers   | 6               | 7               | 7                    | 13              | 9               | 11                   |
| Rural rice wholesalers  | 4               | 2               | 3                    | 0               | 0               | 0                    |
| Urban rice wholesalers  | 3               | 3               | 3                    | 7               | 5               | 6                    |
| Urban traditional retailers   | 13              | 22              | 18                   | 9               | 22              | 15                   |
| <b>Total rewards, costs, and total margins in the value chain (figures in parentheses show the share of the Dhaka retail price)</b> | <b>100 (46)</b> | <b>100 (54)</b> | <b>100 (100)</b>     | <b>100 (55)</b> | <b>100 (45)</b> | <b>100 (100)</b>     |

Source: Authors' estimates.

## Notes:

1. Rewards are calculated as the difference between costs and margins.
2. For farmers, the total margin is the rice equivalent paddy price received per kilogram of paddy, while costs are the sum of the rice equivalent monetary costs of cultivating per kilogram of paddy and the rice equivalent marketing costs per kilogram of paddy.
3. For millers, wholesalers (rural and urban, paddy and rice), and retailers, margins are the difference between the sale price and the purchase price of rice/paddy.
4. For millers and rural paddy wholesalers, margins and costs reported are the rice equivalent margins and costs for handling per kilogram of paddy.
5. To convert per kilogram of paddy prices, costs, and margins to the rice equivalent prices, costs, and margins, the figure for paddy costs, prices, and margins was divided by 0.65, where 0.65 is assumed to be the paddy-to-rice conversion ratio.

**Table 10: Shares of Cost Items in the Rice Value Chain in Bangladesh and India, 2009**

| <b>Bangladesh</b>  | <b>Common Rice</b> | <b>Fine Rice</b> |
|--|--------------------|------------------|
| Total cost in the rice value chain (\$/ton)  | 200                | 190              |
| Share of items in the total cost of rice per ton (%)   |                    |                  |
| Farmers  |                    |                  |
| Rented-in land   | 17                 | 17               |
| Inputs (for all purchased inputs other than land and labor, including purchased seeds, fertilizers, crop chemicals, purchased irrigation, and purchased animal and machine traction) | 36                 | 36               |
| Hired Labor  | 33                 | 33               |
| Mills  |                    |                  |
| Operating costs (electricity, diesel, water, telephone and fax use, rents for stalls and warehouse)  | 1                  | 1                |
| Transport (rents for trucks and costs for transport for transactions)  | 2                  | 2                |
| Wages (hired casual and permanent laborers)  | 1                  | 1                |

*continued on next page*

Table 10 *continued*

| <b>Bangladesh</b>   | <b>Common Rice</b> | <b>Fine Rice</b> |
|---|--------------------|------------------|
| Traders: wholesalers and retailers  |                    |                  |
| Operating costs (for electricity, telephone and fax use, and rents for stalls and warehouses)   | 3                  | 3                |
| Wages (for casual and permanent laborers)   | 2                  | 2                |
| Fees (marketing and weighing fees for the entire value chain)   | 1                  | 1                |
| Transport (hired transport for transactions, rents of trucks, expenses for personal transport for transactions, wholesalers and retailers)    | 3                  | 3                |
| Others (bagging, stitching, grading, loading and unloading, payments at checkpoints/road toll taxes incurred by trader during transactions)   | 1                  | 1                |
| <b>Total</b>  | <b>100</b>         | <b>100</b>       |
| <b>India</b>  | <b>Common Rice</b> | <b>Fine Rice</b> |
| Total cost in the rice value chain (\$/ton)   | 234                | 266              |
| Share of items in the total cost of rice per ton (%)  |                    |                  |
| Farmers   |                    |                  |
| Rented-in land  | 4                  | 4                |
| Inputs (for all purchased inputs other than land and labor, including purchased seeds, fertilizers, crop chemicals, and purchased irrigation) | 32                 | 31               |
| Hired Labor   | 27                 | 26               |
| Transport (for hired transport used in transaction)   | 1                  | 1                |
| Mills   |                    |                  |
| Operating costs (electricity, diesel, water, telephone and fax use, rents for stalls and warehouse)   | 4                  | 4                |
| Transport (rents for trucks and costs for transport for transactions)   | 1                  | 1                |
| Wages (hired casual and permanent laborers)   | 2                  | 2                |
| Traders: wholesalers and retailers  |                    |                  |
| Operating costs (for electricity, telephone and fax use, and rents for stalls and warehouses)   | 5                  | 4                |
| Wages (for casual and permanent laborers)   | 6                  | 5                |
| Fees (marketing and weighing fees for the entire value chain)   | 2                  | 1                |
| Transport (costs of hired transport for transactions, rents of trucks, expenses for personal transport used for transactions)                 | 12                 | 11               |
| Others  | 3                  | 3                |
| <b>Total</b>  | <b>100</b>         | <b>100</b>       |

Source: Authors' estimates.

Note: For farmers, all costs are calculated in "rice equivalent" terms. For this purpose, the cost per unit of paddy was divided by 0.65, where 0.65 is assumed to be the paddy-to-rice conversion ratio.

## VI. CONCLUSIONS AND IMPLICATIONS FOR FOOD SECURITY

The survey has shown that rice value chains are transforming in Bangladesh and India. The main elements of the transformation are as follows:

- i. Rice value chains in both countries have begun to "geographically lengthen" and "intermedationally shorten." This has involved an orientation from subsistence to commercial agriculture in the zones near large cities, from selling to local final consumers toward selling to the big cities, and from selling to village traders toward selling to wholesale market traders and mills.
- ii. Farmers capture about 60% of the final urban retail price of rice. This can be compared to about 23% in 1998 and 37% in 1980 in the United States (Elitzak

1999); it can also be compared to a much higher share of capture in traditional situations where farmers are selling into local markets in their same villages.

- iii. The corollary is that about 40% of the value chain is formed by the postharvest segments of the rice value chain—in milling, trading, and retailing. This implies that these segments are nearly as important as the farm sector in forming the rice price for consumers. Yet the productivity and development of these off-farm segments do not receive even a fraction of the attention in the public debate that the farm sector does. This imbalance should be addressed with much more attention to encourage and facilitate development in the midstream and downstream segments.
- iv. While much policy debate centers on direct government operations in food value chains, such operations were in general quite small in the rice value chain, except for the Government of India's purchases from mills. The implication is that the great majority of the activity in rice value chains is based on private sector actions, whether traditional or modern. Thus, a great deal of emphasis should be placed on enabling the private sector's involvement and providing it with the incentives to assist in attaining national food security objectives.
- v. The indirect roles of governments have been important in enabling change and at times in providing incentives for transformation: (i) by investing in rural areas through research and development, and the distribution of seeds; and by investing in irrigation canal systems, road and railway systems, rural wholesale markets, power grids, and mobile phone communication grids, which were major investments in the 1990s and 2000s. The study observed that all were essential to the transformation in the midstream segments; and (ii) by investing in extension services, which was important overall although the data suggest the limited impact and availability of extension services in some areas, particularly in the Uttar Pradesh study zone in India.
- vi. Government subsidies had important effects, but the evidence of accessibility to subsidies and the impact of the services were mixed. Subsidies for rice seeds and fertilizer sales in all the study countries, as well as for private tube wells in Bangladesh and India, and for mill upgrading in all the zones, appear to have encouraged the use of and investment in all these productive items, which have all have played important roles in transforming the value chains. However, the survey results show that sometimes the subsidies did not go to the target beneficiaries. For example, subsidies for tube wells, fertilizer, credit, and seeds in India went mostly to medium- and large-scale farmers, with little going to marginal farmers. A key policy implication is that if large subsidies are distributed, great care should be taken to ensure that they are properly targeted and delivered.
- vii. The study points to the importance of farm input supply chains upstream from farmers and of midstream and downstream postharvest activities such as logistics and wholesale, milling, and retailing. Little empirical research work has been done in these areas, but much input is needed for policy debate and the systematic evaluation of policy impacts. There needs to be a concerted public policy debate on how to enable and encourage input supply chains to become modernized, and how to help midstream and downstream businesses invest in upgrading their equipment and in expanding.

## APPENDIX: DETAILS OF THE SAMPLING FRAMEWORK

**Rice in Bangladesh.** The Bangladeshi rice farmers and villages were surveyed in November–December 2009. Noagoan was selected for the survey in rural areas as it is an important rice-producing district. It is about 200 kilometers north of Dhaka.

The village and household survey was set up as follows. For rice farm households, the two most important rice-producing counties (*thana*) in Noagoan were selected. In each county, five villages were randomly selected from three village strata—two from high-producing, two from medium-producing, and one from low-producing villages. In each selected village, a village questionnaire was implemented.

In each village, a census of households was conducted to enumerate the paddy producers. Using the census questionnaire, all the households in the village were listed. Each household was asked questions about total land cultivated and about rice cultivation in particular. In each of the 10 villages, 22 households were then randomly selected for a total of 220—half from the largest farm group and half from the smallest—to reflect their relative importance in the rice value chain.

To sample the rural rice mills, a list of all the millers in Noagoan District was obtained. A stratified random selection of 20 millers was done, consisting of eight automatic, five semi-automatic, and seven small mills. Small mills typically first parboil paddy and then spread it to dry in the open air. After drying, the paddy is transferred and milled by small Engleberg friction dehullers that remove the husk and polish the rice, all in one unit (Chowdhury and Haggblade 2000). Semiautomatic mills have larger huller and rubber rolls (Rahman 2004). Large-scale automatic mills emerged in the 1980s, financed largely by international financial institutions. These mills integrate steam-pressure parboiling, mechanical forced-air dryers, rubber roller shellers, and polishing machines in a single conveyor-driven, flow-through facility (Chowdhury and Haggblade 2000). In 2006–2007, Bangladesh had 13,329 small, 109 semi-automatic, and 141 automatic rice mills, accounting for 550,204 tons, 8,595 tons, and 22,827 tons of milling capacity, respectively (Food Planning and Monitoring Unit [FPMU] 2009).

In the paddy and rice wholesaler survey, interviews were conducted with first the 17 village and other rural off-wholesale market traders that the households in that village or other traders sold to. Second, 43 traders were interviewed from the local rural wholesale market in the selected district. Third, 30 urban wholesale traders were interviewed in Dhaka, half each in Badamtoli and Krishi markets, the city's two most important rice wholesale markets.

A sample of traditional and modern rice retailers in urban Bangladesh (Dhaka) was surveyed in November–December 2009. First, five districts were randomly selected in different parts of Dhaka (north, east, west, south, and central). In each, a census was done of all markets, and two were randomly selected. At each market, a census of all rice retailers was taken, and 12 traders were then randomly selected and interviewed. A total of 120 traditional retailers were thus interviewed. Second, 20 modern retailers were surveyed. In each district selected for the traditional retail survey, a census of modern retail shops was conducted, and four were randomly selected and surveyed regarding their rice prices.

**Rice in India.** The sample survey of Indian rice farmers and villages was conducted in September–October 2009. The state of Uttar Pradesh was chosen as a main rice-producing state supplying the Delhi market; the district of Shahjahanpur in west–central Uttar Pradesh was chosen because it was the nearest to Delhi, and thus was comparable to the rice regions

chosen in Bangladesh and the PRC in being a major rice-growing area near the capital city. The Uttar Pradesh Ministry of Agriculture provided a list of the four subdistricts (*tehsils*) and their total rice area. From the four subdistricts, the three with the largest rice area—Jalalabad, Powayan, and Tilhar—were chosen for the survey. The subdistricts' offices provided, for all their villages, data on cropping patterns and land use in the main rice season, the rainy or *kharif* season. On the basis of the data, the villages were categorized as high-, low-, and medium-density villages, depending on the share of area cultivated for rice in the subdistrict's total farmland. A subdistrict with less than 10% of its total farmland under rice cultivation was categorized as low density, 10%–20% as medium density, and more than 20% as high density. For each of the three subdistricts, five villages were chosen—two randomly from the high-density, two from the medium-density, and one from the low-density villages—for a total of 15 villages per subdistrict.

In each village selected, a census of households was conducted. Using the census questionnaire, all the farm households in the village were listed. Each household was surveyed about total land cultivated and land under rice cultivation. In each village, 18 households were selected, giving a total of 270 households surveyed. The households selected were first ranked in descending order by their land size. Then, seven households were randomly selected per village from farms that together cultivated more than 50% of the village's total cultivated area, and eight households were chosen from the rest. The statistical results report both sample averages and population-weighted results, using the population weights from the census.

In Shahjahanpur District, 25 mills were sampled randomly by size (milling capacity) strata. The sample was drawn from the district total list of 65 registered mills provided by the Uttar Pradesh government. The list showed the milling capacity of each mill and whether it was automatic or semi-automatic. The mills were ranked for the study in descending order by milling capacity. Then eight were randomly selected (with some attrition due to mills that were not traceable or willing to respond) from the mills that constituted less than 50% of the total milling capacity in the district, and 17 from those constituting more than 50% of the total. These eight mills in the lower stratum were automatic, while the 17 in the upper stratum were semi-automatic.

As the village surveys indicated that each village had about one paddy trader, all paddy traders in the 15 villages were surveyed. To survey the rural wholesalers in the subdistricts, a list of wholesale markets for grains was obtained through information from farmers, village traders, and the subdistrict offices. Then, the subdistrict government provided the list of rice traders in each wholesale market. All 42 rice traders in the rural wholesale markets were surveyed—23 paddy and 19 milled-rice traders. Of the total, 13 paddy and 11 rice traders were in Shahjahanpur Mandi, the main wholesale market in Shahjahanpur District; and 5 paddy and 4 rice traders were in both Jalalabad Mandi and in Tilhar Mandi.

For the rice traders in Delhi, the sample was taken in Naya Bazar wholesale market, the main rice market in Delhi. The sample included 23 wholesalers chosen randomly.<sup>1</sup> In addition, 10 semi-wholesalers, who bought rice from Naya Bazar wholesalers and sold to small shops elsewhere in Delhi, were surveyed. The names and addresses of the semi-wholesalers were collected from the traditional retailers surveyed.

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<sup>1</sup> There was some attrition due to unwillingness to respond, but there was no discernible bias in trader size related to the unresponsiveness.

For the urban rice and potato traditional retail survey in Delhi, surveys were conducted in March 2009. The following distills the sampling method discussed in the study by Minten, Reardon, and Sutradhar (2010). Delhi is divided into 12 zones and a total of 272 wards, with each ward containing several colonies, the smallest urban geographical unit. For this study's sample, one ward was randomly selected in each of Delhi's 12 zones.

Two types of surveys were implemented in each ward. First, a census of food retail outlets was conducted. If a ward had fewer than 10 colonies, all were covered in the census exercise; if a ward had more than 10 colonies, 10 were randomly selected within the chosen ward. A census was taken of all operating private modern retail outlets and wet markets selling one of the two products. Within the 10 colonies, five were then randomly selected. Within the five, a census was conducted of all the other retail outlets—pushcarts, Safal outlets (a cooperative chain), Fair Price Shops, and small-scale (*kirana*) shops—that sold either of the two products covered.

The retailers were then surveyed—focusing on their retailing practices for the selected products, the prices they charged, and relevant quality questions. The survey focused on two types of rice retailers: private modern retailers and small shops. All modern retail outlets in the 10 colonies were surveyed for the two products. Four small shops and one retail outlet were randomly selected and interviewed in each of the five selected colonies. In all, per ward and per product, 20 traditional retailers, 10 consumers, one Safal outlet, and all private modern retailers were covered, for a maximum of 10 colonies. This survey was conducted from 16 February to 19 March 2009. At the end of March and the beginning of April, a second smaller survey was conducted in six of the 12 selected wards, wherein randomly selected retailers in each category were asked about their turnover the day before. During this second round, all Fair Price Shops in the five selected colonies of each ward were visited during regular store hours. Whether the shop was open was noted, and, if it was, rice qualities were recorded. Additional information on the structural characteristics of the modern retail stores was also collected during this survey.

In all, for the retail survey for rice and potatoes, 561 pushcart retailers, 518 wet market retailers, and 650 small-scale (*kirana*) shop owners were interviewed, and 674 consumer exit interviews were conducted.

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## **The Transformation of Rice Value Chains in Bangladesh and India: Implications for Food Security**

This paper takes off from an exhaustive study conducted in 2009–2010, which found that rice and potato value chains in Bangladesh, the People’s Republic of China, and India were transforming, and presents the main findings on rice value chains in Bangladesh and India. Specifically, the paper answers questions about the nature and extent of this transformation, as well as its effects on small-scale farmers, midstream actors, workers, and consumers. In addressing these questions, the paper notes the contributions of the private sector and the government in these transformations, which will ultimately lead to poverty reduction and better food security.

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ADB’s vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries reduce poverty and improve the quality of life of their people. Despite the region’s many successes, it remains home to two-thirds of the world’s poor: 1.7 billion people who live on less than \$2 a day, with 828 million struggling on less than \$1.25 a day. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

Based in Manila, ADB is owned by 67 members, including 48 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.

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