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Dynamics of Rural Growth in Bangladesh

Sustaining Poverty Reduction

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1 2 3 4 19 18 17 16

ISBN (paper): 978-1-4648-0876-0
ISBN (electronic): 978-1-4648-0883-8
DOI: 10.1596/978-1-4648-0876-0

Cover photo: © Mahfuzul Hasan Bhuiyan/World Bank. Further permission required for reuse.
Cover design: Debra Naylor, Naylor Design, Inc.

Library of Congress Cataloging-in-Publication Data
Names: Gautam, Madhur, 1960- | Faruqee, Rashid | World Bank, publisher.
Title: Dynamics of rural growth in Bangladesh : sustaining poverty reduction / by Madhur Gautam and Rashid Faruqee.
Description: Washington, D.C. : World Bank, 2016. | Series: Directions in development.
Identifiers: LCCN 2016014218 (print) | LCCN 2016016939 (ebook) | ISBN 9781464808760 (pdf) | ISBN 9781464808838 | ISBN 9781464808838
Subjects: LCSH: Rural development—Bangladesh. | Agricultural extension work—Bangladesh. | Bangladesh—Rural conditions.
Classification: LCC HD2075.6 .G38 2016 (print) | LCC HD2075.6 (ebook) | DDC 338.1095492—dc23
LC record available at https://lccn.loc.gov/2016014218

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Foreword

Bangladesh's economy is vibrant. Healthy growth of nearly 6 percent per year over the past decade has propelled Bangladesh to a remarkable position in the fight against poverty. The number of poor people in Bangladesh dropped by one-third over that decade. The achievements of Bangladesh in improving food security and human development outcomes for its people are impressive and widely recognized. Less well appreciated is the story behind that story—the achievements of Bangladesh in agriculture.

This study, *Dynamics of Rural Growth in Bangladesh: Sustaining Poverty Reduction*, is the result of a partnership between the Government of Bangladesh Planning Commission and the World Bank. It rigorously looks at the changes taking place in the farm and nonfarm segments of the rural economy, at how well the markets for high-value agricultural products are performing, and assesses agriculture-nutrition linkages to delineate the implications for policy and strategic priorities to sustain future rural development, poverty reduction, food security, and nutrition.

The findings are compelling. Agricultural growth matters to—and directly benefits—a disproportionately large number of poor people. In fact, improved agricultural incomes have been the main source of poverty reduction since 2000. Agricultural growth also has a catalytic effect on the broader nonfarm economy; a 10 percent increase in farm incomes generates an increase of 6 percent in nonfarm incomes through strong, economywide forward and backward linkages. An important message of this study is that a balanced growth strategy that focuses on agricultural as well as nonagricultural growth, and that focuses on a more diversified strategy within agriculture, will be more effective than single-sector strategies in delivering the higher growth that Bangladesh requires to overcome poverty, malnutrition, and environmental degradation.

Bangladesh's many advances in the ongoing fight against poverty need to be more widely known in development circles and among policy makers. The purpose of publishing this report is to inform policy, identify strategic directions, and generate consensus on actions that can be taken to unleash resilient, sustainable growth in the rural economy for overall improvement in the lives of ordinary Bangladeshi citizens.

We trust that the findings will find broad appeal with development practitioners and contribute to global thinking on the role of agriculture in achieving rural transformation, underscoring Bangladesh's success story both within the country and externally.

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Acknowledgments

This report was prepared by Madhur Gautam (Task Team Leader) and Rashid Faruqee (Senior Adviser) with contributions from a core study team including Mansur Ahmed, Syud Amer Ahmed, Gnanaraj Chellaraj, Anuja Kar, Shahidur Khandker, Forhad Shilpi, and Patrick Verissimo. Significant contributions, through background papers or as inputs to the final report, were provided by Shahnaz Begum, Md. Nazmul Hoque, Iftikhar Hussain, Grant Milne, Selim Raihan, Hussain Samad, Binayak Sen, Qazi Shahabuddin, Danielle Trachtenberg, Helal Uddin, and Jiaxiong Yao. The study was conducted in collaboration with the Planning Commission and benefited from the guidance and support of Shamshul Alam, A. N. Shamsuddin Azad Chowdhury, Ujjwal Bikash Datta, Saiful Alam Hamidi, Yasmeen Parveen, and other officials of the Planning Commission.

The team gratefully acknowledges the guidance provided at various stages of the study by Mahabub Hossain, M. A. Sattar Mandal, and Nasir Farid. The team is particularly grateful to Mahabub Hossain for making available the full set of longitudinal panel surveys, referred to in the text as the MH panel surveys. The final report benefited from comments and feedback on an early draft by Abdul Bayes, K. A. S. Murshid, Rushidan Islam Rahman, and Sajjad Zohir, and participants at a consultation workshop organized by the Bangladesh Institute of Development Studies.

The study benefited from inputs provided by Akhter Ahmed, Mohammed Asaduzzaman, Ciro Fiorillo, S. M. Monowar Hossain, M. Aminul Islam, Wais Kabir, Umar Kamarah, Zahurual Karim, A. A. M. Shahid Khan, Qazi Kholiquzzaman, Nicholas Minot, Satta Ranjan Mondol, Mustafa Kamal Mujeri, Mihir Kanti Muzumdar, Alejandro Nin-Pratt, Wahid Quabili, Mahfuzur Rahman, Mustafizur Rahman, Wahidur Rahman, Shahidur Rashid, Md. Abdur Razzaque, Arun K. Saha, David Spielman, and Selima Sultana.

The team also received inputs and support from colleagues within the World Bank Group, including Sushenjit Bandyopadhyay, Chris Delgado, Zahid Hussain, Sanjay Kathuria, Rita Lohani, Sherif Muhtaseb, Nadeem Rizwan, Ousmane Seck, Manievel Sene, Iffath Shariff, Lin Shi, Lia Sieghart, Emmanuel Skoufias, Hosna Ferdous Sumi, Sugata Talukder, and Salman Zaidi. Administrative and team support was provided by Tarak Chandra Sarkar, Amani Haque, Tahsina Akbar, Mohammad Baharul Alam, and Lilac Thomas.

The study was peer reviewed by John Nash, Dean Joliffe, Robert Townsend, and Sergiy Zorya. It was prepared under the overall guidance of Johannes Zutt (former Country Director for Bangladesh, Bhutan, and Nepal), and Simeon Ehui and Martien van Nieuwkoop (former and current Practice Managers in the Agriculture Global Practice, respectively). This report was edited by Kelly Cassaday.

This study was supported by the South Asia Food and Nutrition Security Initiative (SAFANSI), managed by the World Bank with contributions from the Governments of Australia and the United Kingdom.

Executive Summary

The rural economy in Bangladesh has been a powerful source of economic growth and has substantially reduced poverty, especially since 2000, but the remarkable transformation and unprecedented dynamism in rural Bangladesh are an underexplored, underappreciated, and largely untold story. Its origins are found in the mutually reinforcing forces of policy reform, technological progress, investments in infrastructure and human capital, and the persistent enterprise of rural Bangladeshi households. The progress achieved so far is commendable, yet poverty and malnutrition remain unacceptably high, posing a continuing challenge: how can Bangladesh accelerate and channel its rural dynamism to sustain the gains toward eliminating poverty, achieving shared prosperity, and advancing the aspirations of the people and economy toward middle-income status?

The study described here—undertaken in partnership with the Planning Commission—provides an empirical basis for answering that question by analyzing the dynamics of rural growth. The analysis identifies the key changes occurring in the rural economy, the principal drivers of rural incomes, the implications for policy, and related actions to foster future growth, further reduce poverty, and improve food security and nutrition. A substantial strength of this study is its empirical foundation, consisting of three sets of detailed data on rural households. Two of the datasets are unique in tracking the same set of households for more than two decades. These data make it possible to examine how change is occurring within and among rural households; they shed considerable light on trends that tend to be obscured at more aggregate levels of analysis. Nationally representative surveys and aggregate secondary data provide complementary and contextually rich insights into the household data.

Principal Findings

Agriculture in Bangladesh has performed extremely well, despite being one of the sectors that is most vulnerable to climate shocks. The trend growth rate (over rolling 10-year periods) has increased steadily for the past two decades, reaching a high of 5 percent in recent years—high by agricultural growth standards. This growth has been driven primarily by productivity growth, underpinned by a combination of technical progress and efficiency gains triggered by

policy reforms. The major macroeconomic and trade reforms of the early 1990s, building on the momentum of previous agricultural reforms in agricultural input and output markets, had a significant positive impact on agricultural productivity. Total factor productivity (TFP) has grown at an average annual rate of about 2.7 percent—among the highest in the world, comparable to China and better than the star performers in East Asia.

Agriculture's performance is even more impressive considering that it has been achieved in the face of adverse incentives created by some macroeconomic policies (in essence, while "swimming against the tide"). Even under the much-improved policy framework, domestic terms of trade for agriculture have steadily declined. An implicit anti-agriculture domestic policy bias has persisted with continued protection for the manufacturing sector, likely aggravating rural-urban income and poverty gaps. This macropolicy context also means that while agricultural growth has been helped by higher food prices in recent years (a matter of concern to many), the steadily accelerating long-term growth in agriculture is not simply a price effect—it has been driven by productivity growth.

The evidence clearly demonstrates the pro-poor and catalytic nature of agricultural growth, which has been the leading contributor to poverty reduction in Bangladesh since 2000. The analysis provides important insights into the structural transformation under way in Bangladesh, much of which is occurring within the rural space, from the farm sector to the rural nonfarm sector. The fortunes of much of the rural nonfarm economy depend on the performance of agriculture, reflecting the changing role of agriculture from being a direct contributor to gross domestic product (GDP) to a more leveraged contributor. Analysis confirms the strong role of agriculture for growth and poverty reduction: a 10 percent increase in farm incomes generates an increase of 6 percent in nonfarm incomes through strong forward and backward linkages.

Pathways out of poverty are neither linear nor predictable, as confirmed by the analysis of the dynamics of poverty. Panel data that allow the same households to be tracked over time show that even during a period of robust growth such as 2000–13, a large share of households regularly "churn" into and out of poverty, indicating a high level of vulnerability. Given the substantial risks associated with both farm activities (mostly natural risks, but also market-related risks) and nonfarm activities (which carry economic and business as well as personal and health risks), upwardly mobile households pursue multiple strategies for generating income, diversifying their risks, and adopting reinforcing pathways out of poverty. Agriculture also provides an important safety net for households engaged in nonfarm employment but facing significant business or market risks. It is thus not surprising to find that the vast majority (and an increasing share) of rural households rely on both farm and nonfarm incomes, with about 87 percent of households reporting at least some income from agriculture. In other words, most rural households retain one "leg" in agriculture as central to their strategy to climb out of poverty. These findings are important for Bangladesh's development strategy; they also contribute to the global thinking on rural transformation and the role of agriculture for poverty reduction and shared prosperity.

Two statistics provide compelling evidence on rural households' confidence in agriculture and on agriculture's importance for sustaining progress in poverty reduction: the deepening of agricultural capital per worker, even as nonagricultural capital per worker has declined, and the rise in leasing of land for cultivation by landless and functionally landless households. Remittances are an important pathway out of poverty, but given that so many households have limited access to this source of income growth, remittances have contributed relatively less to poverty reduction on average than either farm or nonfarm sources of income.

The most important drivers of agricultural growth—facilitated by policy reforms since the 1980s and strategic investments in research and infrastructure—have been irrigation expansion, modern technology (high-yielding varieties), better road connectivity, more efficient markets, and increased mechanization. In the last few years, high real prices have also significantly helped farmers, but only by preventing a further deterioration of the terms of trade, which remain well below the levels of the mid-1990s. The bulk of the growth has been through increased yields, and more precisely through TFP growth, reflecting high returns to agricultural research and policy reforms.

It is increasingly apparent that agriculture must diversify more rapidly if Bangladesh is to meet changing demand, improve nutrition, and adapt to a changing climate. The overall structure of agriculture has changed little. Rice continues to dominate the crop sector and has driven much of the growth in agricultural productivity. The share of high-value agriculture (horticulture, livestock, and fisheries products) has grown, but slowly. The progress on diversification partly reflects the past emphasis of policy and strategy on the production of food grains, principally rice, to achieve food security. Food security remains the central objective of the government's agricultural strategies, and it continues to be pursued through policies and public interventions to maintain the incentives for rice production, including output price support, price stabilization, and input subsidies. Leveling the playing field to promote more robust diversification is an important priority going forward, given changing consumption patterns and the need to improve nutritional outcomes through a more diverse diet. A step in this direction would be to remove the remaining regulatory constraints to private sector participation in the seed sector (as has been done for hybrid maize and maize) to inject new technological vigor.

The time is opportune to explore the most effective and efficient ways to support agriculture. Significant potential remains to increase productivity and incomes in agriculture, while making it more climate-resilient and nutrition-sensitive. Farmers remain heavily invested in rice even though nonrice crops and noncrop agriculture offer significantly higher incomes. To induce farmers to adopt these nonrice agricultural enterprises, their returns need to be further stabilized and solidified through investments in technology, markets, and infrastructure. Yet the much-needed investments in public goods to bring about this change—including investments in research (especially on the long-neglected nonrice crops, livestock, and fisheries), extension, and infrastructure—remain very low. The largest share of the public expenditure on agriculture goes to

fertilizer subsidies, which have increased significantly since 2007. At the same time, an important finding from the farm-level analysis is that considerable wastage appears to be associated with the use of fertilizer. Almost half of all farmers overuse fertilizer, but that excess fertilizer is not delivering any additional output. Further, the overuse of chemical fertilizers imposes large potential environmental and health costs. Priorities to address this issue are to provide appropriate technical advice to farmers through extension services while removing the incentives that encourage farmers to overuse inputs.

Although agriculture remains the dominant source of rural livelihoods, nonfarm incomes will continue to grow in importance, and so will the need to adopt strategies to promote more robust development of the rural nonfarm economy. The role of agriculture and farm incomes remains highly relevant for the welfare of the vast majority of rural households, yet as farm sizes decline, even more households will seek to earn income off of the farm. A little-remarked statistic from the 2010 Labour Force Survey is that rural nonfarm employment in Bangladesh is almost 50 percent greater than all urban employment put together. Rural nonfarm employment is also growing faster than urban employment, and three-quarters of rural households have at least some form of nonfarm income. Clearly, a high priority to facilitate more rapid economic transformation is to implement strategies that will improve the enabling environment for creating better and more productive jobs in the rural nonfarm sector.

A strategy to promote robust development of the rural nonfarm economy should pay attention to the country's secondary cities. Aside from agriculture, key drivers of growth in the rural nonfarm sector are connectivity and proximity to urban areas. The need for strategy and policy to focus on previously neglected secondary cities is highlighted by an interesting combination of facts. More jobs are located near the megacities of Dhaka and Chittagong, but the growth has been in informal and seemingly vulnerable jobs, while (surprisingly) the shares of all other (more productive) types of jobs have fallen. Well-connected cities have had positive growth in jobs of better quality (especially businesses). Poorly connected cities have shown no dynamism when it comes to creating employment, calling attention to the need for infrastructure development.

An emerging concern is that rural nonfarm activities do not seem to be growing in scope or sophistication over time. Many rural nonfarm activities are still linked to agriculture, consistent with the process of transformation—processing, trading, food preparation, and so on—but the conundrum is that they are not moving much from basic to more sophisticated activities. This stagnation in the types and quality of nonfarm activities is puzzling, because such activities, especially rural nonfarm enterprises, are associated with higher returns. At the same time, the rate of return to rural nonfarm enterprises is not associated with urban proximity. It may be that because most rural nonfarm enterprises still produce traditional and low-quality products, they cannot compete with cheaper and better quality mass-produced goods.

A binding constraint on rural nonfarm enterprises is the lack of credit, although the lack of infrastructure (for power and water) is also important. Lack

of credit is reported as the more pervasive constraint. The majority of enterprises use their own funds to finance investment and expansion.

Given rapid growth in the share of rural nonfarm enterprises focusing on trading, especially in agricultural produce, the good news from surveys of traders and farmers is that markets appear to be functioning very well. Marketing margins are quite small and reasonable. Transport costs are the major source of traders' variable costs. The market survey found very little evidence of the much talked about cartelization of markets by a few powerful traders fleecing farmers, or other forms of uncompetitive behavior. Another finding that demystifies another widely held view is that physical postharvest losses are very low (under 5 percent)—much lower than the 30 percent to 40 percent generally quoted.

The liberalized markets of Bangladesh also appear to serve both producers and consumers very well. Comparable data on the high-value commodities surveyed for this report are limited, but for rice, a recent study comparing Bangladesh, China, and India finds that the share of farm-gate price of rice in the final retail prices is higher in Bangladesh than in either of the other two countries.

Improvements in market infrastructure and finance are vital to move Bangladesh to the next level of more modernized and even more efficient supply chains. Further investment is needed in roads, electricity infrastructure, and upgraded market facilities. Traders, especially those operating in markets for high-value products, require substantial working capital and better access to finance.

Projections indicate that the future supply of rice relative to demand is unlikely to be a major concern, but the supply of other food groups needs to grow significantly faster than in the past—raising important questions for policy makers on the strategic priorities for public investments and policy focus. The prospects for agricultural growth, food security, and nutrition are closely linked. Fortunately the trade-off appears to be less of an issue now than in the past, when self-sufficiency in rice was the overarching imperative. The scope for improving rice yields is substantial, especially if farmers succeed in closing the yield gaps for *aman* and *aus* rice. With a continued focus on agricultural research to push the production frontier forward and to build agriculture's resilience to climate and biophysical stress, there is significant potential to release land for much-needed crop diversification.

A more immediate policy priority is to achieve better outcomes in nutrition. Malnutrition rates remain high, with serious human development and economic impacts. Intuitively it can be argued that what happens *to* agriculture is important to sustaining food security, and what happens *in* agriculture matters for improving nutritional outcomes. Clearly, nutritional security is a complex, multisectoral challenge, with many contributory factors, among which agriculture is prominent. The empirical findings show a significant impact of agricultural diversification (out of rice) on dietary diversity, which remains very low in Bangladesh. They also show that dietary diversity has a strong, direct impact on the nutritional status of fathers but not mothers. Women appear to suffer from basic undernutrition, as seen in the body mass index (BMI) of mothers, which is

significantly affected by calorie insufficiency (at the household level). Regarding nutritional outcomes in children under five years of age, the BMI of both parents has a strong negative influence, as do relative prices of foods, reflecting the significant impact of agricultural policies on nutrition.

Single-sector strategies are inferior to a growth strategy that is balanced between agricultural and nonagricultural growth. The scenario analysis using a computable general equilibrium model confirms that superior benefits are associated with a growth strategy stressing both farm and nonfarm growth, and that within agriculture, a diversified production structure performs better in delivering on key development objectives—pro-poor growth and food security (in terms of inducing a higher level of consumption) as well as better nutrition (through a more diversified diet).

Priority Areas for Action

Based on the findings summarized here, the five priority areas for action are:

1. ***A balanced development strategy.*** A development strategy that stresses both farm and nonfarm growth, and at the same time pursues a diversified strategy within agriculture itself (favoring no agricultural subsector over others), is superior to alternative sector-specific strategies in all dimensions of development—to pursue growth, further the gains in poverty reduction, reduce economic vulnerability, maintain food security, and promote better outcomes in nutrition.
2. ***More rapid diversification in agriculture—with carefully balanced attention to rice.*** Within agriculture, diversification into high-value agriculture (noncrop agriculture and crops other than rice) is a priority, but it is important to neither neglect nor overemphasize the rice sector. Consolidating the prospects for rice is important and is eminently feasible, through an approach that emphasizes exploiting the remaining yield gaps, investing in traditional and nontraditional technologies (planting hybrids and responsibly realizing the potential of biotechnology), and leveraging the private sector to move the current technology frontiers. This approach will safeguard past achievements while injecting new momentum into productivity growth and will be critical in building resilience to potential climate change impacts. Strategic priorities include improving aman rice yields and freeing up the more suitable *boro* rice areas for a diverse range of high-value and more sustainable crops, and giving greater attention to various aspects of developing the high-value crop, livestock, poultry, and fisheries subsectors.
3. ***Further improving the policy framework and rebalancing public expenditure priorities.*** At the macro level, policy distortions protecting the nonfarm economy remain and create an implicit anti-agriculture domestic bias. The main issues are analyzed in the Diagnostic Trade Integration Study by the World Bank, which also identifies key actions to address them. Among sectoral policies, a careful review is warranted to assist farmers in pursuing economically

and ecologically optimal use of inputs. Evidence indicates that significant wastages (with large environmental and health costs) are associated with the overuse of chemical fertilizers, which may be due to insufficient technical knowledge or inappropriate incentives. Rationalizing public expenditures to emphasize investments in research (with increased attention to nonrice crops, livestock, and fisheries), extension services, markets, and infrastructure will help to enhance incomes, value chain efficiencies, and competitiveness. Finally, removing the remaining regulatory and institutional constraints to private sector participation in the seed sector will have a large potential payoff.

4. ***An enabling environment for robust rural nonfarm growth and more efficient value chains.*** For rural nonfarm growth to flourish, especially the growth of business enterprises, the empirical analysis reaffirms the essential role of the enabling environment. Access to finance, power, and roads are critical elements of this environment, along with better access to technology and information, and the removal of business environment barriers, such as those influencing terms of trade, discriminatory taxes, and stifling regulations. Value chain analyses highlight the importance of focusing on food safety standards and modern market infrastructure, given the large share of rural nonfarm enterprises that pursue activities related to agriculture (such as trading and processing). The value chain analyses also clearly show that agricultural markets are functioning quite efficiently, with low marketing margins (driven mostly by transport costs), dispelling the general myths on the distortions and inefficiencies associated with the liberalized market environment. The clear priority is to avoid distracting debates and focus on improving market infrastructure and facilitating more efficient value chains.
5. ***Continued investment in connectivity.*** The widespread impact of connectivity is well demonstrated. Looking to the future, continued investments in infrastructure are a high priority. Rural roads have been a key part of the past success in raising productivity, promoting the limited diversification that has taken place, and creating better employment opportunities. Closely related to connectivity is the need to focus on secondary cities that remain poorly connected, because they are potential drivers of economic activity and better quality jobs. The evidence shows that while the megacities have attracted more employment, they have overwhelmingly attracted informal jobs with higher vulnerability. Well-connected cities have had positive growth in business jobs, while poorly connected cities have languished, with no structural change in the types of jobs created.

Abbreviations

AEZ	agroecological zone
BBS	Bangladesh Bureau of Statistics
BDT	Bangladesh taka
BIDS	Bangladesh Institute of Development Studies
BIHS	Bangladesh Integrated Household Survey
BMI	body mass index
BRAC	Bangladesh Rural Advancement Committee
BRRI	Bangladesh Rice Research Institute
CBN	cost of basic needs
CGE	computable general equilibrium
CPI	consumer price index
EEZ	exclusive economic zone
FAO	Food and Agriculture Organization
GDP	gross domestic product
ha	hectare
HH	household
HIES	Household Income and Expenditure Surveys
HYV	high-yielding variety
IFPRI	International Food Policy Research Institute
InM	Institute of Microfinance
IRRI	International Rice Research Institute
kcal	kilocalorie
kg	kilogram
km	kilometer
LFS	Labour Force Survey
MH	Mahabub Hossain (panel surveys)
NGO	nongovernmental organization
NRA	nominal rate of assistance
PSU	primary sampling unit

R&D	research and development
RNF	rural nonfarm
RNFE	rural nonfarm enterprise
RRA	relative rate of assistance
SAM	Social Accounting Matrix
SME	small and medium enterprise
t	ton (metric)
TFP	total factor productivity
WASH	water, sanitation, and hygiene
WBI	World Bank, BIDS, and Institute of Microfinance
WDI	World Development Indicators (World Bank)

All monetary amounts are Bangladesh taka (Tk) unless otherwise indicated.

CHAPTER 1

Introduction

Context and Scope of Study

Unprecedented changes in the rural economy of Bangladesh have brought significant reductions in poverty and increases in economic growth, especially since 2000, yet the remarkable transformation of the country's rural areas and the dynamics of its rural economy remain an underexplored, underappreciated, and largely untold story. Together, policy reforms, changes in technology, investments in infrastructure and human capital, and the persistent enterprise of rural Bangladeshi households offer a compelling case study of how mutually reinforcing actions can trigger the highly sought-after virtuous cycle of rural development.

On the surface, the broad socioeconomic characteristics of the agricultural sector in Bangladesh seem to have changed very little. Nearly 70 percent of the population—and most of the poor—live in areas classified as rural. Rural poverty remains significantly higher and more extreme than urban poverty. Primary agriculture—generally less productive than nonagricultural sectors—still dominates the rural economy in terms of employment, providing income for the overwhelming majority of rural residents. The declining share of agriculture in the economy (as shown in annex 1A, figure 1A.1) reinforces the stereotypical perception of agriculture as a backward sector in decline, beset by relatively weaker performance and higher volatility than other sectors (not least because of the effects of periodic natural disasters). Agriculture appears to offer few prospects for any significant contribution to economic well-being, either through its potential to markedly reduce poverty or its prospects for broadening opportunities for more widely shared prosperity.[1]

These perceptions belie the fact that strong currents of change are moving under the surface, propelled by the structural transformation of the rural economy. Deeper analysis, moving beyond superficial rural-urban, farm-nonfarm, and sectoral profiles, reveals substantial economic vibrancy, mobility, and interdependency.

The findings of the Poverty Assessment Report (PAR) (World Bank 2013) challenged the perception of agriculture as a backward sector and came as a surprise to many. Using data from the nationally representative Household

Income and Expenditure Surveys (HIES), the assessment revealed that growth in farm income drove nearly half of the reduction in poverty in Bangladesh between 2000 and 2010, and that farm income became substantially more powerful as a driver of poverty reduction as the decade progressed. Between 2000 and 2005, growth in nonfarm income accounted for almost 40 percent of poverty reduction, while growth in farm income contributed about 21 percent. These relative contributions changed dramatically between 2005 and 2010, when farm income growth accounted for more than 90 percent of poverty reduction and nonfarm income growth was responsible for only 6 percent.

These findings emphasized the pressing need to understand the dynamics of rural growth in Bangladesh, especially agriculture's role and its relationship to the rural nonfarm economy, given that poverty—despite the remarkable progress since 2000—remains unacceptably high and largely rural. If Bangladesh is to achieve its goal of steadily transitioning to middle-income status, it is vital to pinpoint the factors that are likely to speed the rate at which poverty declines and shared prosperity grows, promote and accelerate sustainable rural growth, and build resilience to maintain food security.

For those reasons, the World Bank, in partnership with the Planning Commission, undertook the present study of the dynamics of rural growth in Bangladesh. Recognizing that an extensive body of knowledge exists on agriculture in Bangladesh, the first step in initializing this study was to take stock of the current state of knowledge (Faruqee 2012). This step was followed by consultations with a broad spectrum of stakeholders, including policy makers, academics, researchers, sector technical experts, and other development partners, to identify the knowledge gaps and define the priority areas of focus for this study.

This identification process pointed to the need for a deeper analysis on (a) sources and drivers of rural incomes, including both farm and nonfarm incomes; (b) the performance of agricultural value chains, particularly for high-value agricultural commodities; and (c) implications of the patterns of agricultural growth for food security and nutrition. To address these issues, this study approaches the challenge of promoting growth through the lens of rural poverty. A rural poverty perspective makes it possible to zero in on the specific diagnostics needed to

- Analyze recent changes in the rural economy and identify key drivers of emerging trends.
- Assess the implications of these changes for future growth, poverty reduction, food security, and nutrition.
- Identify the highest-priority policies and actions required to strengthen and sustain an environment that enables more rapid growth.

This study does not seek to address in depth all issues concerning rural growth. Instead it builds on available studies and complements ongoing analyses by other agencies and research institutions. It makes use of recent in-depth studies on

Bangladesh by the World Bank and others, whose findings remain highly relevant. For example, the detailed and sophisticated analysis of the impacts of climate change on food security highlights the importance of promoting activities and policies that help households build resilience to climate risks (Yu et al. 2010). This study speaks directly to key elements of Yu et al.'s "no-regrets" adaptation strategy to climate change, which would include efforts to (a) diversify household livelihoods and income sources, (b) improve agricultural productivity, (c) promote crop diversification, (d) enhance efficiency in the use of water and land, (e) better manage the natural resource base, and (f) support increased agricultural research and development to tackle future uncertainties. Other studies include an assessment of the agribusiness opportunities and constraints, focusing on high-value agricultural subsectors (World Bank 2008); the Diagnostic Trade Integration Study (Kathuria and Malouche 2016); and a large body of analysis on the investment and business environment in Bangladesh summarized in the Systematic Country Diagnostic (World Bank 2015). Finally, this report complements the ongoing work supported by the World Bank Group as part of its engagement with the Government of Bangladesh—in partnership with the Government of the Netherlands and the 2030 Water Resources Group—to prepare the Bangladesh Delta Plan 2100, which seeks to create a long-term vision and investment strategy to build Bangladesh's resilience to climate change.

Many concepts and topics integral to this analysis—examples include "rural economy," "farm" and "nonfarm," and "rural" and "urban"—are variously defined in the literature, owing to their overlapping and interdependent qualities. To provide some clarity, box 1.1 explains how some of these key concepts are defined in this report. The careful reader will bear in mind that many empirical findings cited in the chapters that follow come from studies that differ in their definitions and interpretations of terms, and that while additional clarifying statistics and data are provided where possible, it is neither feasible nor advisable to repeat much of the very rich and insightful analysis that exists in Bangladesh.

This study adopted a deliberately empirical approach to keep the analysis as objective and factual as feasible. The analysis therefore relied on a large number of sources for data and other information, including a new survey of market participants along the value chains for selected high-value products. It used national and district aggregate data from the Bangladesh Bureau of Statistics (BBS) for national accounts statistics and agricultural production, along with agricultural data from the Food and Agriculture Organization (FAO). Sources of household data include the nationally representative HIES for 2000, 2005, and 2010, and the Labour Force Survey (2005 and 2010), as well as three unique household surveys. One is a household panel survey conducted by the Bangladesh Institute of Development Studies (BIDS), International Rice Research Institute (IRRI), and Bangladesh Rural Advancement Committee (BRAC), under the guidance of Dr. Mahabub Hossain since the late 1980s. The panel surveys—henceforth referred to as the "MH panel surveys"—were undertaken in 62 study villages covering all districts of Bangladesh in four rounds (1988, 2000, 2004, and 2008) and supplemented by relatively more limited census data for 2013 from

Box 1.1 Key Terms

Rural economy describes the economy of a rural area, which encompasses population concentrations in farms, villages, and towns below a threshold level defined by the national statistical bureau in its broad rural-urban classification. In Bangladesh, that threshold is 40,000 individuals.

Agriculture is the sector consisting of crops, livestock, agroforestry, and fisheries (excluding natural forest, which is managed under a different approach than is applicable for agriculture). The terms **agriculture** and **farm** are used interchangeably throughout this report and refer to the same measures, concepts, and issues pertaining to the agricultural sector. Broad sectoral aggregates of income, poverty, and employment include the contributions or shares of labor when referring to the broad **farm** and **nonfarm** categorization. **High-value agriculture** refers to fish, livestock products, fruits, vegetables, and spices that have a higher market value than traditional food grains. **Nonfarm activities** include all rural economic activities outside farm agriculture, such as self-employment, wage employment (full-time, formal, informal, and seasonal), and nonfarm production.

A **driver of growth** is an economic activity that creates growing demand for other economic activities through two routes. It can (a) raise incomes, which are then the source of growing consumer demand for the products of the other activities, or (b) create derived demand on the input side for other outputs and create demand for processing downstream.

all 64 villages. Another longitudinal household panel survey, conducted by the World Bank, BIDS, and the Institute of Microfinance (InM), provides two rounds of data (for 1998–99 and 2010–11) and is referred to as the "WBI data." The third survey is the nationally representative Bangladesh Integrated Household Survey (BIHS), conducted by the International Food Policy Research Institute (IFPRI), which collected data for 2011–12. These micro-level datasets provided most of the data used to obtain the original empirical findings presented here; for details on the two panel datasets, see annex 1A, "Macroeconomic Structure and the Microdata Used in the Study," and for details on the BIHS, see IFPRI (2013). The market surveys undertaken for the analysis of the value chains for high-value agricultural products are described in annex 5A.

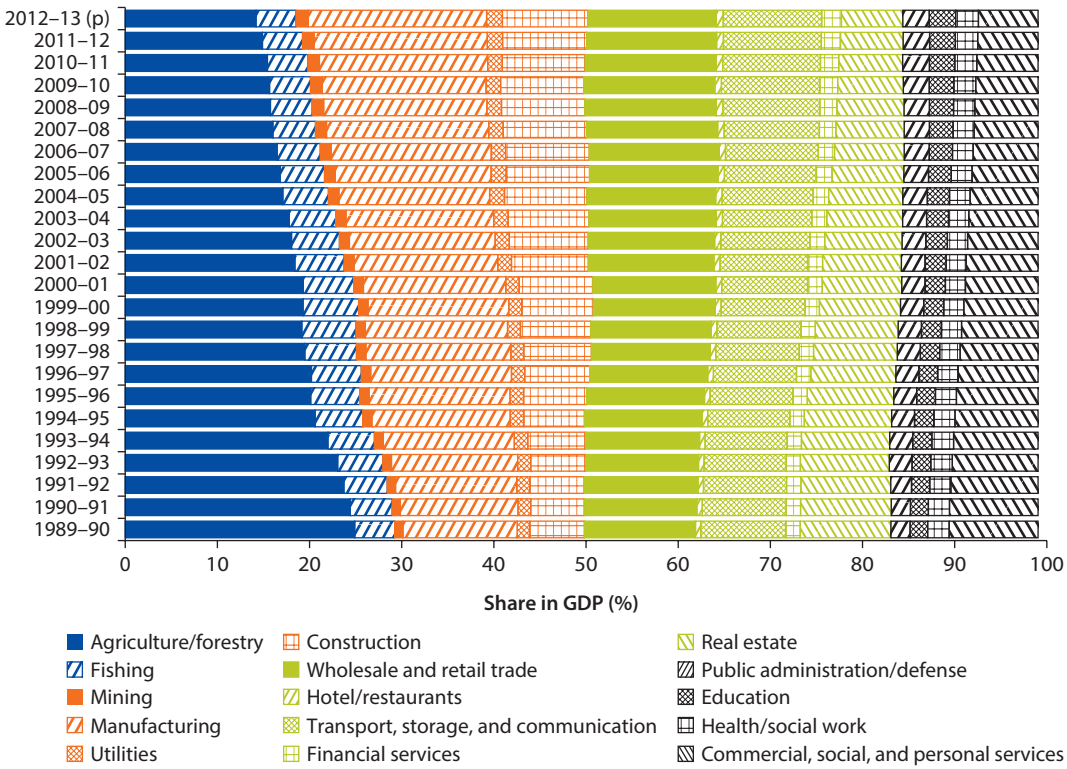
Chapter 2 provides a detailed descriptive review and deeper analysis of the drivers and dynamics of change in the rural economy—in household poverty, income sources, and employment status—including the roles of the farm and nonfarm sectors in rural employment and incomes. Chapter 3 focuses on the evolving structure of agriculture, including sources of agricultural growth, the varied contributions to growth by agroecology and subsector, and the effects of policy reforms. This exploration of the farm sector is followed in chapter 4 by an analysis of growth in the nonfarm sector, with particular attention to how the sector has been developing over time, across geographical areas, and through

various types of rural nonfarm enterprises. Over the past two decades, the marketing of agricultural products has benefited from infrastructure investments and agricultural policy reforms that fostered private investment in trade, transport, and other services. Chapter 5 reports new findings from value chain surveys to investigate how well markets and value chains are functioning. Chapter 6 examines the dimensions of food insecurity and malnutrition in Bangladesh, especially in relation to strategic priorities for public investments and policy. Each chapter is followed by a summary of the analytical results and the implications for policy and strategy to sustain progress in improving growth, reducing poverty, and fostering shared prosperity. The final chapter briefly lists all of the priority areas for action.

Annex 1A: Macroeconomic Structure and the Microdata Used in the Study

Composition of GDP

Figure 1A.1 Sectoral Composition of GDP, 1989–2013



Source: BBS, national accounts data.
Note: p = projected.

Data Used for Microanalysis

The micro-level findings discussed in this report are based on in-depth analyses of three rich household-level surveys: (a) the national representative repeated cross-sectional HIES conducted by the BBS for 2000, 2005, and 2010; (b) nationwide panel surveys by BIDS-IRRI-BRAC undertaken in 62 villages spanning 25 years and conducted in 1988, 2000, 2004, and 2008, with a supplemental census of the study villages with more limited information in 2013; and (c) World Bank–sponsored microcredit long panel data spanning over 20 years, from surveys conducted in 1991–92, 1998–99, and 2010–11.

HIES Repeated Cross-Sectional Surveys

Detailed descriptions of these surveys are available from BBS. In brief, the data for this study came from three rounds of HIES, carried out by BBS in 2000, 2005, and 2010, to determine the poverty profile of Bangladesh. The data are geographically representative of the entire country and provide information about the standard of living and nutritional status of the population in urban and rural areas. A two-stage stratified sampling technique was used, in which the primary sampling units (the PSUs, roughly comparable to blocks of villages in rural areas or street blocks in urban areas) were selected in the first stage, and households were selected in the second stage. The number of PSUs selected was 442 in 2000, 504 in 2005, and 612 in 2010. Roughly 20 households were randomly selected from each of the PSUs, resulting in 7,440, 10,080, and 12,240 households in 2000, 2005, and 2010, respectively.[2] While the PSUs across the surveys were not comparable, there was a significant overlapping of *upazilas* (subdistricts) across the surveys.[3] The survey covered 295 upazilas in 2000, 366 in 2005, and 386 in 2010. Since the individual households cannot be tracked across the surveys, panel analysis of the survey data across years is possible only at the upazila level. The final and cleaned dataset contains 5,030, 6,031, and 7,840 rural households from 2000, 2005, and 2010, respectively.

BIDS-IRRI-BRAC Longitudinal Data: MH Panel Surveys

The MH panel surveys refers to a series of longitudinal surveys of a nationwide sample of rural households in Bangladesh initiated and undertaken over the years under the leadership of Mahabub Hossain. The survey spans about two decades (1988–2008) with 4 rounds of surveys (1988, 2000, 2004, and 2008). The surveys were undertaken to assess changes in rural poverty and livelihoods and identify the roles of different factors driving those changes, such as technological progress, prices, and so on. The baseline survey was administered by the BIDS in 1988 to 1,240 rural households from 62 villages in 57 of 64 districts in Bangladesh to study the impact of technological progress on income distribution and poverty in Bangladesh (Hossain et al. 1994). IRRI revisited the households in 2000, 2004, and 2008 to study the impact of rice research on poverty reduction (Hossain et al. 2006). The 2004 and 2008 surveys were also used for poverty mapping in Bangladesh and for assessing the impact of the rise in food prices on rural livelihoods.

The benchmark survey used a multistage random sampling method. The sample size has been adjusted in each round of the survey to make the sample representative of the rural population for the survey year. In the first stage, 64 unions were selected randomly from the list of all unions. In the second stage, one village was selected from each of the unions that best represented the unions in terms of population density, land distribution, and literacy rate. Two villages were excluded later because their remoteness posed challenges for administering the survey. A census of households was conducted in the selected villages to stratify households according to land ownership, land tenure, and literacy. A random sample of 20 households was selected from each village such that each stratum was represented by its probability distribution.

For the repeat surveys in 2000, 2004, and 2008, enumerators revisited the original households and their offshoots. The repeat surveys also included additional households from the same villages to address the sample attrition problem. The sample sizes in the repeat surveys were 1,880, 1,930, and 2,010, respectively. Because the sample size is larger, much of the analysis in this report used data from the three later survey rounds from 2000 to 2008. Data from the 1988 survey were used selectively to highlight some long-term trends. Aside from the larger sample size, the main reason for using the 2000, 2004, and 2008 survey data for the deeper analysis was to focus on the dynamics and drivers of farm income growth in the last decade, which was the purpose of this study.

World Bank, BIDS, and InM (WBI) Microcredit Long Panel Survey

The HIES data are not panel at the household or enterprise level; hence any analysis of productivity growth and drivers of rural nonfarm activities (RNF) growth based on HIES data will be biased owing to unobserved factors (for example, entrepreneurial ability, which contributes to RNF growth as well). Because the data are not collected at the enterprise level over time, analysis using the HIES data might not capture the dynamics that the RNF sector experienced over the last decade. The dynamics of sectoral issues may be better examined by analyzing the panel dataset collected by the World Bank with the help of BIDS and InM. This dataset has detailed coverage of microenterprise activities undertaken by households, including sources of finance, as well as data on key public goods (such as the density of rural roads or the distance to various infrastructures), allowing for high-resolution analysis of households' RNF activities and of the extent to which growth in households' RNF activities can be explained by the enabling environment (for details on the dataset, see Khandker and Samad 2014).

The World Bank and BIDS carried out the first survey in 1991–92 to study the role of microfinance in poverty reduction. The sample of 1,769 households was drawn randomly from 87 villages of 29 upazilas in rural Bangladesh. In 1998–99, again with the help of BIDS, those households were revisited, but only 1,638 households were available for the repeat survey owing to attrition. The resurvey included some new households from old villages and a few newly included villages. Altogether 2,599 households were surveyed in 1998–99, of

which 2,226 were from old villages (allowing for the new households that had split off from the initial households) and 373 from new villages.

The households were surveyed again in 2010–11, this time with InM. The resurvey tried to visit all the households (2,599) surveyed in 1998–99. Due to attrition, 2,342 households were located, which grew to 3,082 households to include those that had split off. The analysis for this study is based on the 1,509 households from 1991–92 that were included in all three surveys. Of course, because of household split-off, the number of households is higher in 1998–99 (1,758) and 2010–11 (2,322). For the sake of completeness, this report uses the unbalanced dataset.

Advantages and Drawbacks of the Datasets

Both datasets have advantages and drawbacks. The HIES is a large dataset, representative of the population and regions, but the panel survey is drawn primarily from low-income areas targeted by microfinance institutions in the early 1990s, and the data thus have a sample bias for poorer areas. The HIES data covering 2000, 2005, and 2010 are not panel data (that is, they do not have observations on the same unit at different points in time) at the household, PSU, or village level. As noted, panel analysis of these data can be done at the upazila level, which has limitations (unobserved factors at the household level may affect estimates drawn at the upazila level). On the other hand, the long panel data are drawn for the same households and communities over the 20-year period. This dataset is truly a long household panel in which it is possible to control for unobserved household and community characteristics.

Although this report analyzes the two datasets separately, it is worthwhile to examine at the outset how comparable they are. Two points are important to emphasize. First, HIES households from the lower 60 percent of the sample (based on income) are comparable to the full sample of the WBI long panel data, after excluding the nonpoor population from the latter (based on the sample in the first round of 1991–92). Second, Khandker and Samad (2014) compare HIES data of 2000 with the 1998–99 data of the WBI long panel, and HIES data of 2010 with the 2010–11 data of the WBI long panel, because only these survey years are close enough to be comparable between the two datasets. They find that the important outcome variables from the two datasets related to incomes (total, farm, and nonfarm) and expenditures (total, food, and nonfood) are not statistically significantly different in most cases. Only the total income and nonfarm income between the HIES 2010 and long panel 2010–11 datasets are found to be different. While these differences (or lack thereof) between the two datasets are important to keep in mind, the report will investigate how trends in the outcomes and other findings vary between the two datasets.

A Note on Consistency between MH Panel Surveys and HIES of BBS

The analysis takes advantage of the unique panel data structure of the MH panel surveys. The surveys cover all parts of the country, but since the sample is not nationally representative, it is important to analyze the comparability of the MH

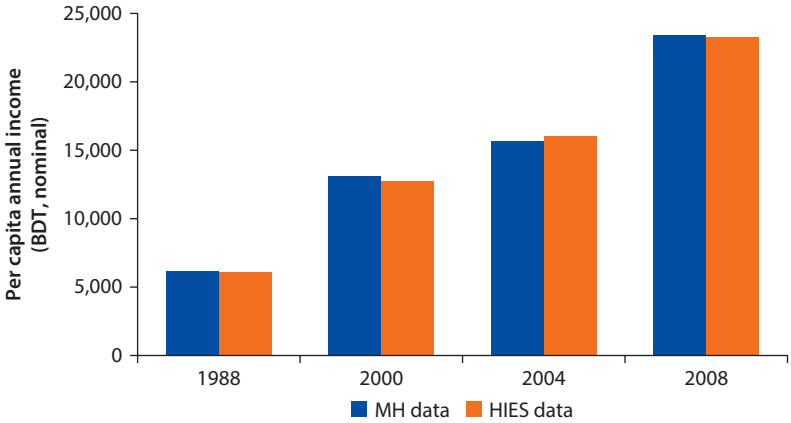
panel survey data with the nationally representative data to assess whether meaningful inferences can be drawn. A high degree of comparability would add to the main advantage of the MH panel surveys over the HIES, which is its longitudinal nature, which allows a deeper analysis of dynamics in rural Bangladesh.

To check the validity and consistency of the MH panel surveys, key statistics (those that can be meaningfully compared, given the differences in the variables and definitions in each survey) from the MH panel surveys and the rural sample of HIES were compared for 2000, the only year of overlap, allowing a valid comparison. In 2000, the HIES sample covered 5,040 rural households, while the MH panel surveys included 1,911 households.

One important difference between the two surveys is that the MH panel surveys contain data on production and other income-generating activities of rural households but not on consumption. HIES includes consumption and income-generating activities but no data on production. An important implication of these differences is that the MH panel surveys allow estimates of poverty using only incomes and not consumption. Poverty statistics are normally measured using consumption expenditure.

For that reason, it is necessary to examine the differences in poverty estimates using the related but distinct measures of income vs. consumption. One consistency check compares income estimates from the two surveys. Per capita annual income from two different surveys for four rounds is presented in figure 1A.2. Income for the HIES survey has been adjusted to the nearest years in which the MH surveys were conducted, adjusted by the rural consumer price index (CPI). The figure shows that the comparable per capita annual income from both datasets are almost identical, and statistical tests fail to reject the null hypothesis of equality of the income estimates from the two

Figure 1A.2 Per Capita Annual Income Comparisons Using HIES and MH Panel Surveys



Sources: MH panel surveys (various years); World Bank calculations using BBS, HIES (various years).
Note: HIES incomes for 1988, 2004, and 2008 have been generated using rural CPI from the closest survey.
BDT = Bangladesh taka; CPI = consumer price index.

sets of surveys. The conclusion thus is that rural income estimates from both surveys are statistically comparable.

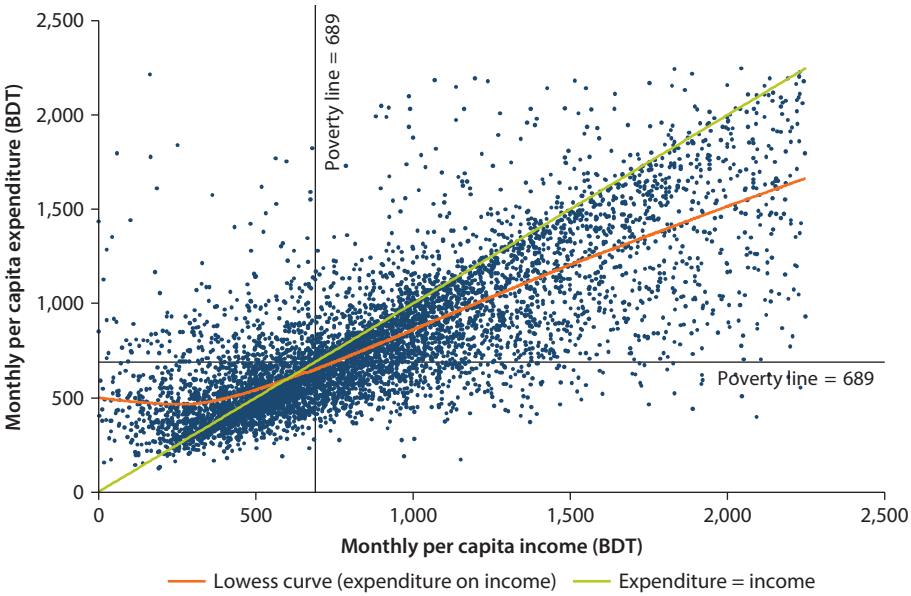
Another important consistency check of the data from these two surveys is the estimate of rural poverty. Poverty rates from both surveys are compared in table 1A.1. As noted, a key difference in the poverty estimates is that poverty from the MH panel surveys is based on per capita incomes while poverty from HIES is estimated using per capita consumption expenditures, both using the same reference poverty lines from HIES. How much of a difference this might make involves understanding the relationship between the per capita expenditure and the per capita income. There is an obvious and natural relationship, but consumption is normally considered a more reliable indicator (due to measurement errors, but also as an indicator of a household's permanent income, and consumption levels may differ from income levels at any point in time due to various consumption-smoothing mechanisms a household may have at its disposal).

In general, income is expected to be higher than consumption for a typical household (reflecting some amount of saving) at any given level of expenditure. As such, poverty rates estimated based on the same level of income as poverty-level consumption expenditures may thus be expected to be higher than the poverty rates estimated based on consumption expenditures. This income-consumption gap is expected to grow with higher levels of income (consumption), reflecting the falling marginal propensity to consume. On the other hand, it is not unusual to observe some households with consumption levels higher than their income levels, reflecting dissaving (or transfers), typically at very low (and typically below poverty) income levels.

To check the relationship between income and expenditure, a nonparametric relationship (using a Lowess curve) between consumption expenditure and income using the 2000 HIES data is plotted in figure 1A.3. The figure shows that the poverty line cuts the 45-degree line, which reflects equality between income and consumption expenditure, at a point marginally above the Lowess curve, which implies that poverty estimates based on income are expected to be marginally underestimated compared to poverty estimates based on expenditure. However, the scenario flips when considering the lower poverty line, with the Lowess curve above the 45-degree line (not shown), in which case estimates of extreme poverty based on income are overestimated compared to poverty estimates based on consumption expenditure.

The similarity of the poverty estimates derived from income and consumption measures is shown in the distributions of the two derived measures (using kernel density distribution) in figure 1A.4. More households are below the upper poverty line based on expenditure than below the line based on income. It is thus clear that poverty estimates based on income will give lower estimates of poverty than the poverty estimates based on expenditure. Finally, figure 1A.5 shows the kernel density distribution of per capita annual incomes from the two surveys. The distributions are similar, with income from HIES showing slightly higher incomes per capita. Therefore poverty estimates based on income using upper poverty lines from MH panel survey data provide a reasonably accurate picture of the level of poverty derived from the HIES consumption-based measures.

Figure 1A.3 Lowess Curve of Per Capita Income on Per Capita Expenditure, 2000 (Truncated at 90th Percentile)



Source: BBS, HIES 2000.
Note: BDT = Bangladesh taka.

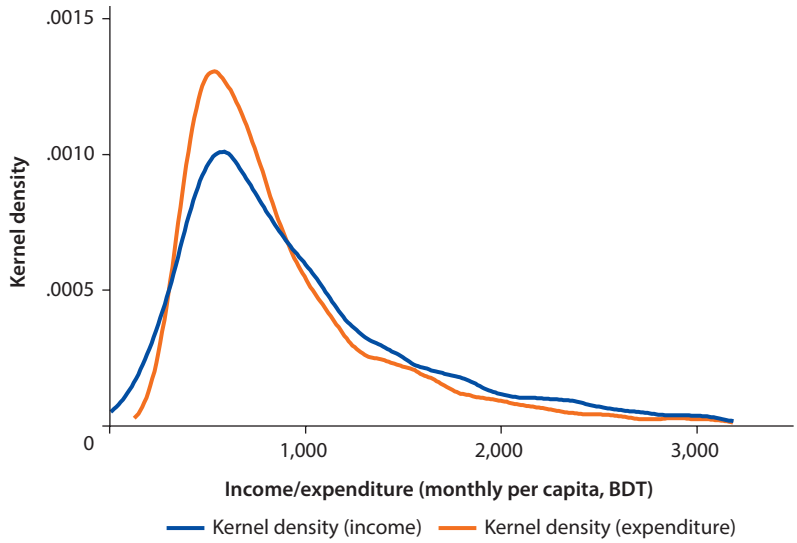
Next, the actual estimates of poverty derived from both data sources are given in table 1A.1, using both the upper and lower poverty lines. The estimates based on the upper poverty line from both the MH panel surveys and HIES are consistent. For 2000, the MH panel survey data give the headcount poverty estimate of 51 percent compared to the estimate from HIES of 52 percent. Similarly, the headcount estimate from the 2004 MH survey is similar to the estimate from the 2005 HIES data. As expected, the estimates using the lower poverty line are higher from the MH panel survey data.

Other readily comparable sample characteristics across the two sets of surveys are household characteristics and land ownership. Mean household size for different rounds of the surveys, given in table 1A.2, are found to be quite consistent in both the levels and trend over time.

Another important consistency check is to compare land distribution in the two surveys. The MH surveys give relatively more weight to farm households (given their focus on agricultural activities) compared to HIES, as seen in table 1A.3. While 60 percent of the rural households covered in HIES are functionally landless, 43 percent of the households in the MH survey are functionally landless.

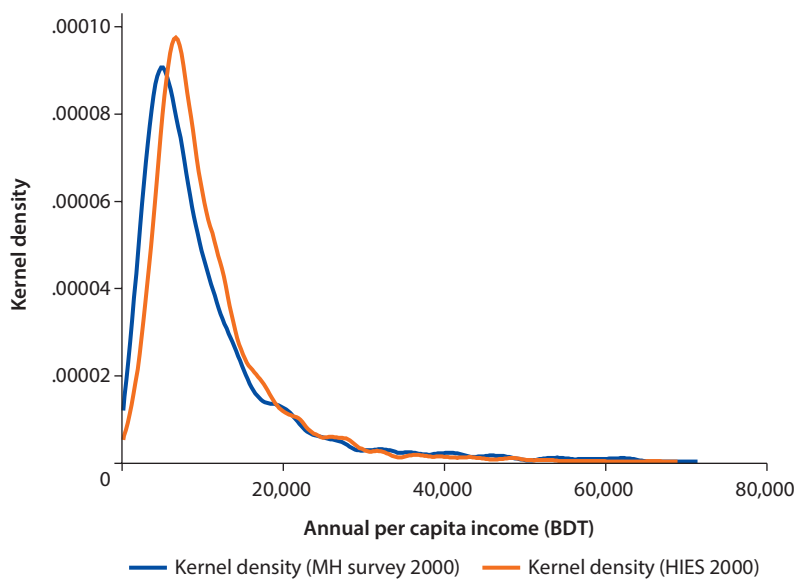
To conclude, despite some differences in orientation between the HIES and MH panel surveys, the two samples are found to be reasonably comparable, allowing reasonably accurate inferences to be drawn from the dynamic analysis using the MH panel surveys.

Figure 1A.4 Kernel Density Per Capita Income and Expenditure, 2000



Source: BBS, HIES 2000.
Note: BDT = Bangladesh taka.

Figure 1A.5 Kernel Density Function of Income, 2000



Sources: BBS, HIES 2000 and MH panel survey 2000.
Note: BDT = Bangladesh taka.

Table 1A.1 Poverty Rates Derived from HIES and MH Surveys

	Headcount poverty rate			
	Upper poverty line		*Lower poverty line*	
Survey year	*MH surveys*	*HIES*	*MH surveys*	*HIES*
1988	58.60	—	49.12	—
1989	—	59.20	—	44.30
2000	51.28	52.30	43.17	37.90
2004	43.12	—	36.70	—
2005	—	43.80	—	28.60
2008	37.46	—	28.16	—
2010	—	35.20	—	21.10

Note: — = not available.

Table 1A.2 Mean Size of Sample Households, HIES and MH Surveys

	Household size	
Survey year	*MH surveys*	*HIES*
1988	5.87	—
2000	5.25	5.18
2004	5.08	—
2005	—	4.85
2008	4.94	—
2010	—	4.50

Note: — = not available.

Table 1A.3 Land Ownership Patterns, HIES and MH Survey, 2000

Land ownership group	*MH survey*	*HIES*
Absolutely landless	7.2	5.6
Functionally landless	43.1	60.0
Marginal farmer	15.2	9.5
Small farmer	19.2	15.4
Medium and large farmer	15.4	9.4

Notes

1. Agriculture's share in total GDP was 32 percent in 1980. It has declined steadily since, to 29 percent in 1990, 25 percent in 2000, and an estimated 18 percent in 2013. Over the long term, between 1980 and 2013, agricultural GDP grew at 3.0 percent compared to overall economic growth of 4.8 percent.
2. Except for 140 urban PSUs in the 2000 survey (where 10 households were selected per PSU), the number of households selected per PSU was 20 for all PSUs across all surveys.
3. An *upazila*, which is the lowest administrative unit (after division and district), is at a higher level than a PSU in the geographical hierarchy, and can contain about 10–50 PSUs (villages).

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CHAPTER 2

The Dynamic Rural Economy

Changing Economic Context

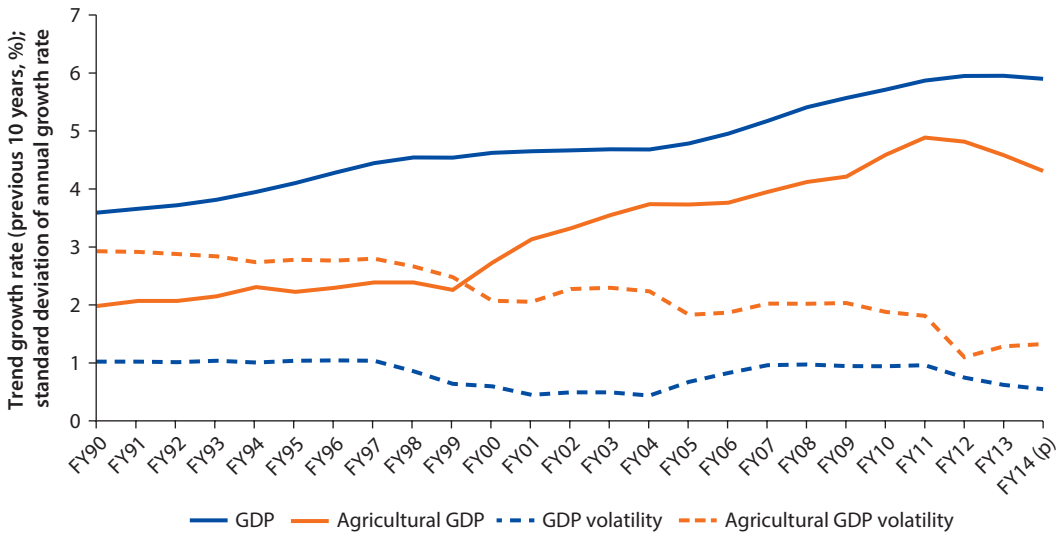
For the Government of Bangladesh to achieve its stated goal of becoming a middle-income economy by 2021, national gross domestic product (GDP) must grow at a sustained rate of over 7 percent per year until then (World Bank 2012). Bangladesh's recent performance is encouraging. Overall GDP (trend) growth accelerated steadily from under 4 percent in the 1980s to approach 6 percent in the most recent 10-year period.

Agricultural growth also improved progressively (figure 2.1). Starting from a low of around 2 percent in 1990 (reflecting growth in the 1980s), it improved only marginally (to about 2.2 percent) through the 1990s but then accelerated sharply and steadily to peak at almost 5 percent around 2010—an impressive rate of growth compared to agriculture globally. Growth has moderated somewhat in recent years, but remains near its historical highs.

The sharp increase in the trend growth rate for agriculture around 1998 suggests that a structural break occurred in the sector's growth trajectory. In fact, the standard Zivot-Andrews unit root test[1] detects a break in 1996, the year that policy reforms were completed. The break in the trend is not visually perceptible until a couple of years later, likely due to the impact of the massive floods in 1998. The wide-ranging reforms implemented from 1991 to 1996 aimed to achieve macroeconomic stability, increase the orientation toward private sector–led growth, initiate trade and a broader economic liberalization with an explicit outward emphasis, and renew the focus on agricultural and rural development (Ahmed et al. 2009; Mujeri 2008). The reforms' significant positive impact on agriculture is visible in the subsequent rapid acceleration of agricultural growth.

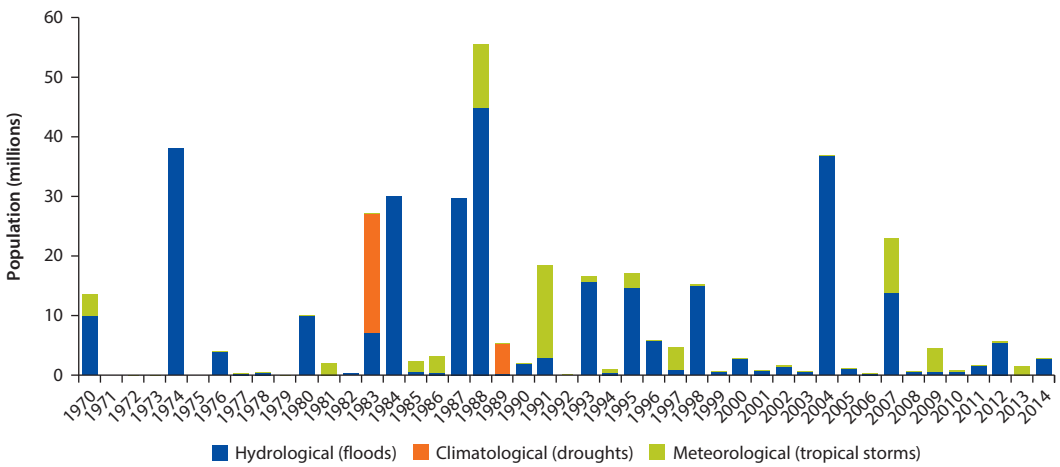
Agricultural growth has also become markedly less volatile, partly because relatively fewer major natural disasters have occurred since 2000 compared to previous decades (figure 2.2). Floods have historically been the most devastating natural disasters in Bangladesh, but storms also regularly pound coastal areas. A second factor that has reduced volatility is the increasing resilience of agriculture, which absorbed two major, damaging shocks in 2004 and 2007 reasonably well.

Figure 2.1 Total and Agricultural GDP: Trend Growth Rate and Growth Volatility



Source: BBS, national accounts data.
Note: Trend growth rate is estimated over each of the previous 10-year periods; volatility is measured as the standard deviation of the annual growth rate over the same (previous) 10-year period. p = projected.

Figure 2.2 Incidence of Natural Disasters and Number of Persons Affected, 1970–2014



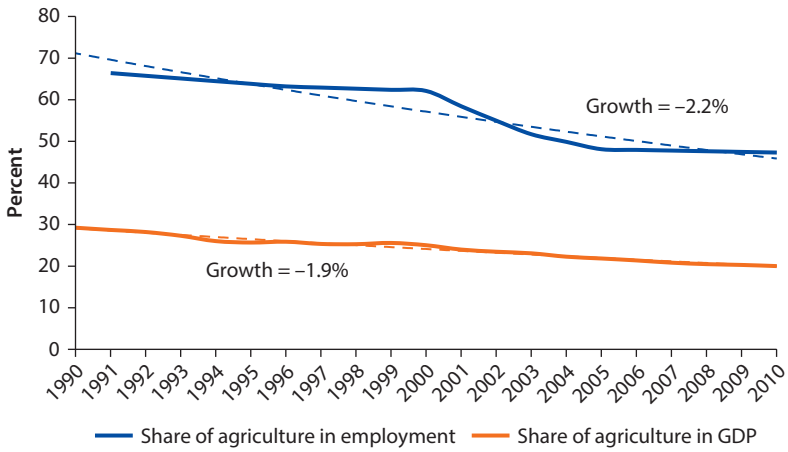
Source: EMDAT (Emergency Events Database; http://www.emdat.be/).

Resilience has increased through the rapid spread of irrigation, the contributions of different subsectors within agriculture (crops, livestock, forestry, and fisheries), and the spread of agricultural technology.

The structural transformation of the economy in Bangladesh has followed the familiar pattern observed in transforming economies worldwide (figure 2.3). Relative to most other developing countries, Bangladesh is ahead of the curve,

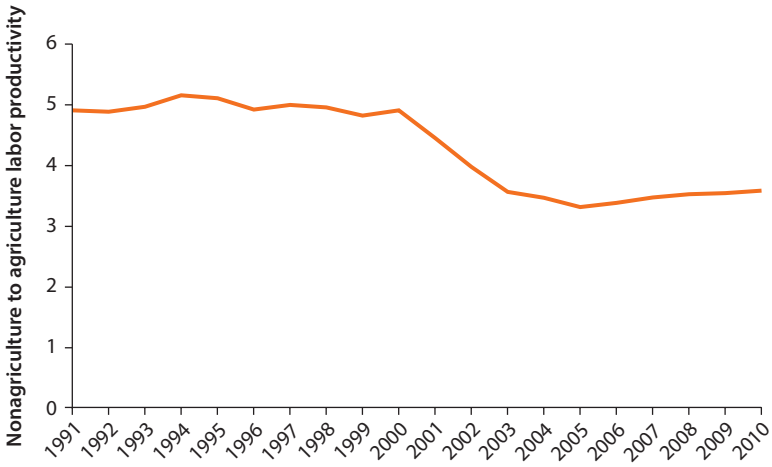
since the share of agriculture in total employment is falling faster than the share of agriculture in GDP. Agriculture's employment share fell at an annual rate of 2.2 percent between 1990 and 2010 (the latest year for which employment data are available), while its share in GDP fell at a rate of 1.9 percent over the same period (from about 30 percent in 1990 to about 20 percent in 2010) and is now at 19 percent (as per the national accounts data for 2013).[2] As is also typical of transforming economies, labor productivity is significantly higher in nonagricultural sectors than in agricultural sectors (figure 2.4). But good agricultural growth

Figure 2.3 Structural Transformation: Share of Agriculture in GDP and Employment



Sources: BBS, LFS (various years) and national accounts data; WDI.
Note: Dashed lines are trends. LFS = Labour Force Survey; WDI = World Development Indicators.

Figure 2.4 Ratio of Nonagricultural to Agricultural Labor Productivity



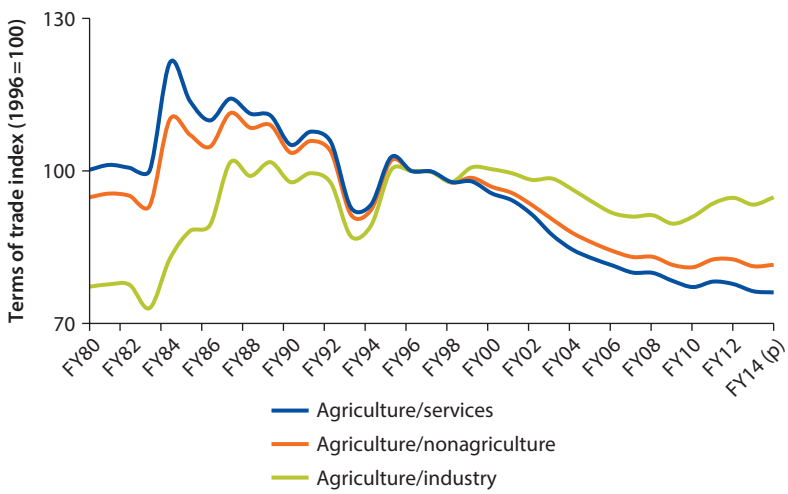
Sources: World Bank calculations using BBS, national accounts and LFS (interpolated for intersurvey years).
Note: LFS = Labour Force Survey.

and the exodus of labor from agriculture have significantly narrowed this gap since 2000.[3]

Agriculture's overall performance since the mid-1990s is all the more remarkable because it has occurred in a challenging macropolicy environment. Two major indicators of the broad policy-induced incentive structure facing agriculture are the aggregate sectoral terms of trade and the external and macropolicy environment, as summarized in the nominal and relative rates of protection. The agricultural and nonagricultural terms of trade, calculated as the ratio of the GDP deflator for agriculture to the GDP deflator for the rest of the economy (indexed at 1996 = 100) favored agriculture in the 1980s but deteriorated steadily after 1995 (figure 2.5). Figure 2.5 also displays trends in the terms of trade for agriculture in relation to industry and to the services sector. The deterioration in terms of trade was significantly worse for agriculture in relation to the services sector, declining steadily through 2014. The agriculture and industry terms of trade experienced a minor bounce after 2009—although remaining well below the 1995 benchmark—reflecting the global food price spikes in 2007 and higher relative real prices for agriculture afterward. The overall terms of trade for agriculture, in which the services sector weighs more heavily than the industrial sector, have remained flat and significantly depressed, however.

The conclusion emerging from these trends is that while price increases arrested the deterioration in the terms of trade and possibly reversed it to a limited extent against industry, agriculture's recent improved performance cannot be attributed largely to higher real food and agricultural prices, a concern expressed by many observers. Instead, the overall improvement in agricultural growth has been driven more by improved productivity, with investments in infrastructure,

Figure 2.5 Trends in Terms of Trade for Agriculture and Other Economic Sectors



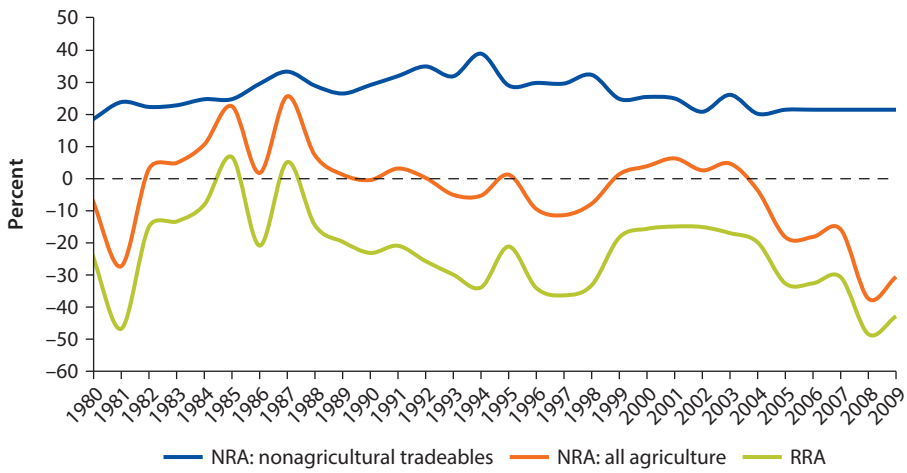
Source: BBS, national accounts data.
Note: p = projected.

physical and human capital, and technology, as discussed in the following chapters of this report.

The influence of macropolicy on overall incentives for agriculture is also reflected in the level of assistance afforded to agriculture (figure 2.6). The nominal rate of assistance (NRA) measures the extent to which public policy alters the incentives for farmers by raising (or lowering) domestic prices relative to the external market prices, and the relative rate of assistance (RRA) provides a measure of the domestic distortions as differential policies across sectors alter the relative prices across sectors (Anderson 2009).

External trade policies appear to have had a fairly neutral effect on agriculture from the 1990s to about 2004, with the NRA showing minor annual fluctuations, implying that Bangladesh has maintained a stable external policy framework that generally did not distort incentives for farmers. In other words, agriculture experienced no implicit taxation or implicit subsidies until about 2004. Between about 2004 and 2009 (2009 is the latest year for which estimates are available), agriculture was increasingly heavily taxed. During that period, as global food prices soared, Bangladesh maintained domestic prices below world market prices. In contrast, the domestic policy environment for agriculture was characterized by a large and consistently negative RRA. That is, the neutral external trade policy for agriculture coexisted with protection for the nonagricultural tradeables, creating an implicit domestic policy bias against agriculture: protection raised the domestic prices of goods produced by the other sectors relative to their competitive levels while agricultural goods were competitively priced, effectively taxing agriculture.

Figure 2.6 Nominal and Relative Rates of Assistance



Source: Anderson and Nelgen 2012.
Note: NRA = nominal rate of assistance; RRA = relative rate of assistance.

The negative RRAs for agriculture resonate with findings of the Diagnostic Trade Integration Study (Kathuria and Malouche 2016), which discuss Bangladesh's current trade policy in detail and highlight the remaining inconsistencies and distortions in the trade regime. Kathuria and Malouche report that while the Bangladeshi economy has become increasingly open since independence (1971), with significant reforms in the early 1990s, trade liberalization has experienced periodic reversals. Tariff rates generally have been scaled down, but myriad para-tariffs and duties still protect selected industries. Consumers and export sectors (other than the garment industry) bear the brunt of the consequences of protectionist policies that reduce incentives to export and diversify and raise domestic prices.

Because levels of taxation vary across and within sectors, incentives across sectors and products are distorted. Estimated levels of taxation show that textiles, foodstuffs, and vegetable products are taxed the least, whereas other sectors are subject to much higher levels of border taxation. These underlying distortions and uneven taxation lead to the implicit taxation of agriculture, as shown by the negative RRAs for agriculture in figure 2.6.

Transforming Rural Economy

Much of Bangladesh's structural transformation is taking place within the rural space. The process of growth and change in the rural economy has not been uniform in all areas, but the effects are evident both within and outside agriculture. The steady though not dramatic transition in the structure of economic activities has been reviewed by Rahman (2014) and is summarized in table 2.1. The scarcity of arable land (estimated at 0.05 hectares per capita) probably poses the most serious obstacle to Bangladesh's future agricultural growth, given that its population density is among the highest in the world. The challenge to agricultural livelihoods is clearly indicated by the very small amount of arable

Table 2.1 Changes in Income and Employment in Agriculture and Rural Nonfarm Activities (RNF), 2000–10

		Year		*Increase in 10*
Sector	*Item*	*2000*	*2010*	*years (%)*
Agriculture	Employment (millions)	18.7	22.74	21.6
RNF	Employment (millions)	11.6	18.92	63.1
Agriculture	Annual income of rural HH (million BDT, 2010 prices)	613,307	913,566	48.96
RNF	Annual income of rural HH (million BDT, 2010 prices)	615,426	995,461	61.75
Agriculture	Share of income (%)	49.9	47.8	n.a.
RNF	Share of income (%)	50.1	52.2	n.a.

Source: Rahman 2014.
Note: BDT = Bangladesh taka; HH = household; n.a. = not applicable.

land per agricultural worker (averaging 0.26 hectare per worker over 2006–11, according to the Food and Agriculture Organization [FAO]).

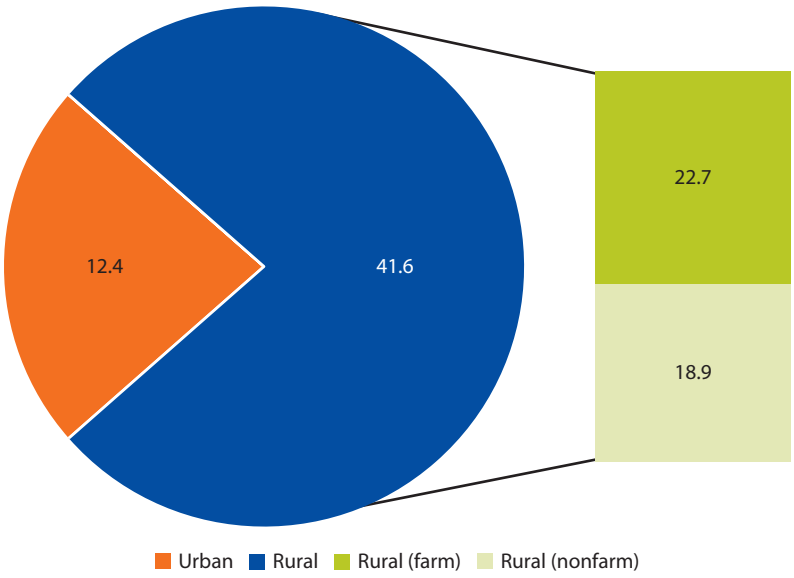
Certainly rural households need to diversify their income sources and livelihood strategies, not only to manage risk but also to ensure more rapid growth. The evidence suggests that such diversification is well under way in Bangladesh. Two particularly important dimensions of the evolving rural structure deserve attention. First, the process of transformation has not followed the generally assumed rural-urban pattern. Second, what emerges is a pattern of income diversification rather than discrete changes in livelihoods or occupational shifts of entire households.

Structure of Rural Employment

An important facet of Bangladesh's structural transformation is that much of it is taking place within the rural space and is not driven by the typical shift from rural to urban employment. Understanding how this process is unfolding is essential for understanding the dynamics of poverty and income growth, which will be discussed later in this chapter (see "Changing Poverty Profile" and "Patterns and Drivers of Income Growth of Rural Households").

The nationally representative Labour Force Survey (LFS) (BBS 2010), summarized in figure 2.7, shows that in 2010 almost 42 million, or 77 percent, of the 54-million-strong national workforce was employed in rural areas.

Figure 2.7 Urban and Rural Workforce, 2010
millions



Source: BBS, LFS 2010.

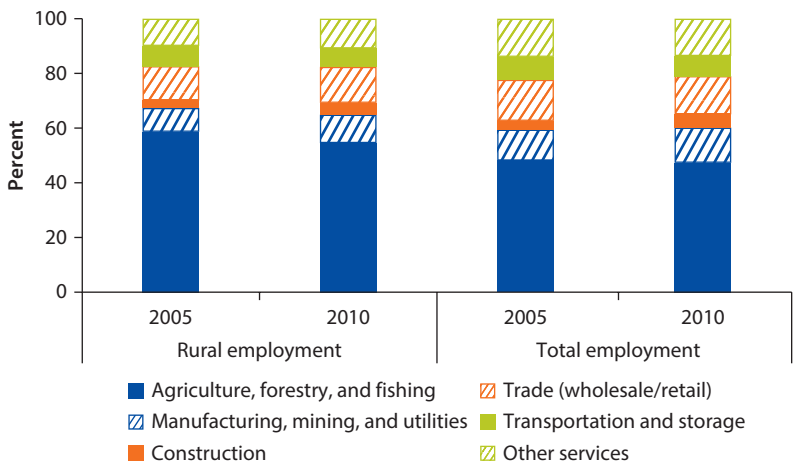
This share was marginally higher than the 76 percent estimated in 2002–03 and 2005–06 LFSs. Among all forms of employment (rural and urban), agricultural employment occupied just over 47 percent of the workforce, a modest decline over previous LFSs (52 percent in 2002–03, 48 percent in 2005–06).[4]

Between 2003 and 2010, most nonagricultural jobs created in Bangladesh were in rural and not urban areas, as generally presumed. Urban employment increased at about 2.1 percent annually over that period (from 10.3 million in 2002–03 to 11.3 million in 2005–06 and 12.4 million in 2010). In contrast, rural employment grew at 3.1 percent, providing an additional 2.5 million jobs between 2002–03 and 2005–06 and a substantial 5.5 million between 2005–06 and 2010. By 2010, employment in the rural nonfarm sector was 18.9 million compared to total urban employment of 12.4 million, or over 50 percent higher.

Cities still attract workers, probably because more services are available, yet the urban unemployment rate (about 6.8 percent, having grown at a staggering 15.8 percent between 2005–06 and 2010) was almost double the rural unemployment rate (3.9 percent, having grown by 1.5 percent per year). These magnitudes and trends have significant implications for policy, development strategy, and public expenditure priorities if the objective is to reduce poverty more rapidly and share prosperity more widely.

Agriculture, defined as including agricultural wage labor and self-employed farming, provided most of the jobs in rural areas in 2010 (22.7 million as shown in figure 2.7) and occupied more than 54.5 percent of the rural workforce (a slight decline from 58.6 percent in 2005–06) (figure 2.8). Agriculture remained the dominant employer of both the rural and total labor force. The sector employed a significantly higher share of women in 2005–06 (78.8 percent)

Figure 2.8 Agriculture Continues to Dominate Rural and Overall Employment



Sources: BBS, LFS 2005 and 2010.

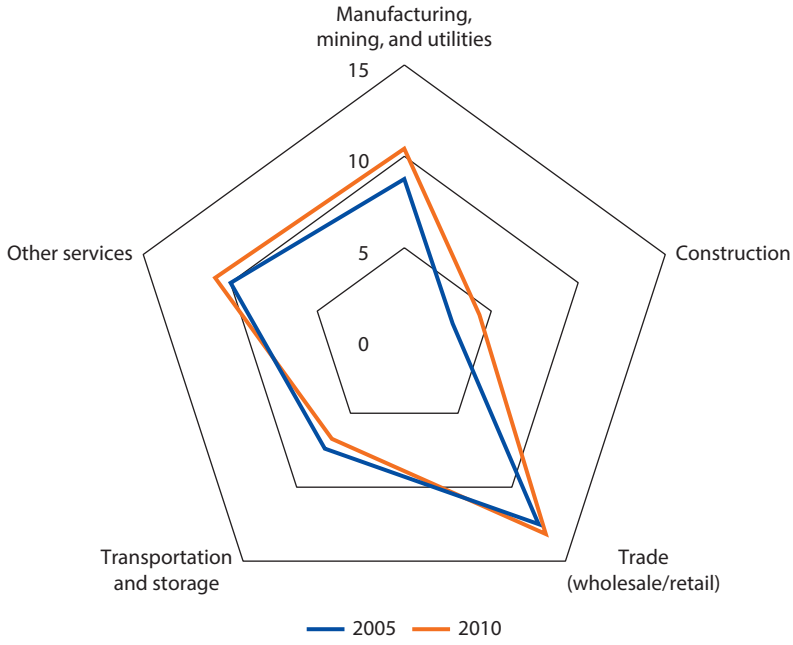
than in 2010 (69.5 percent), and in both years, agricultural employment was higher among women than men, who formed 52.3 percent of the rural male workforce in 2005–06 and 48.1 percent in 2010.

The structure of rural nonfarm employment, using the broad categories of employment in the LFS, changed little between 2005 and 2010. Trade continued to provide the largest share of nonfarm jobs, with some increase in manufacturing and construction employment (figure 2.9).

The MH panel surveys describe the broad composition of the rural workforce reasonably well. The shares of agricultural employment (including farmers and agricultural labor) from the MH panel survey and LFS appear fairly consistent (figure 2.10). A more detailed comparison of nonfarm jobs is not possible due to definitional differences between the two surveys.

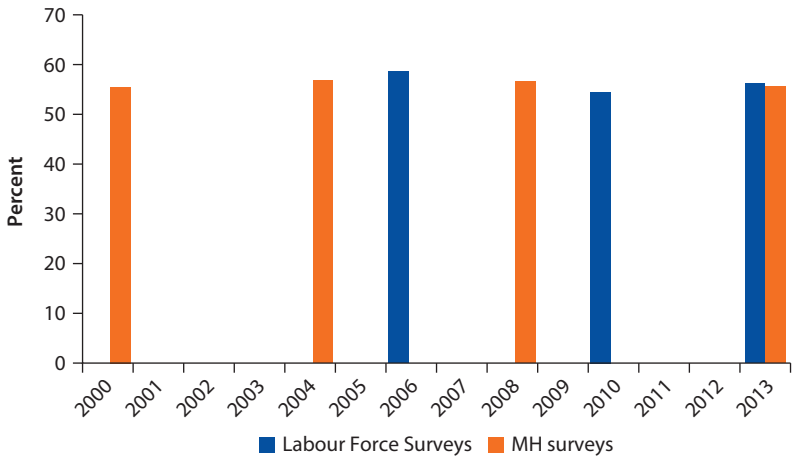
The panel data show that the shares of farmers (self-employed) and of agricultural labor have declined as employment has expanded in business activities (table 2.2). Employment in services and transportation has changed very little. It is noteworthy that the shares of employment in services requiring lower skills (a primary education or less) or higher skills (more than a primary education) remained static, indicating that the composition of the service sector does not appear to be shifting toward a more skilled workforce.

Figure 2.9 Shares of Rural Nonfarm Employment in Total Rural Employment, 2005–10
percent



Sources: BBS, LFS 2005 and 2010.

Figure 2.10 Share of Rural Workers in Agriculture



Sources: BBS, LFS (various years); MH panel surveys (various years).

Table 2.2 Percentage of Rural Employment, 2000–13

Employment type	*2000*	*2004*	*2008*	*2013*
Farming	42.1	46.3	43.0	39.6
Agricultural labor	11.7	10.1	11.8	9.2
Nonagricultural labor	3.9	2.8	3.3	6.3
Business	15.8	14.5	14.4	18.4
Transportation	7.0	6.2	6.9	6.5
Low-skilled service	8.1	7.6	8.5	8.0
High-skilled service	11.4	12.6	12.1	12.0

Sources: MH panel surveys.

Sources of Rural Income

In 2010 nearly 87 percent of rural households earned some income from agriculture, whereas 77 percent earned some form of nonfarm income (Household Income and Expenditure Survey [HIES] data, table 2.3). Slightly more rural households are drawing income from nonfarm as well as farm sources (65 percent in 2010), up from 63 percent in 2000), confirming the increasing tendency to pursue multiple income-generating strategies.

The picture that emerges from table 2.1, which uses household-level aggregates, shows the growing size (in macro terms) of rural nonfarm activities. Averages at the household level provide a more accurate picture at the micro level, however, by taking account of the inequality in incomes and important demographic changes in households, specifically the decline in household size and changes in the number of workers.

Key welfare measures for rural households derived from HIES between 2000 and 2010 (summarized in table 2.3) show that the share of households

Table 2.3 Sources of Income for Rural Households, 2000–10

Welfare indicators	*2000*	*2005*	*2010*
Per capita total income (BDT/month)	899	991	1,188
Per capita farm income (BDT/month)	424	385	579
Per capita nonfarm income (BDT/month)	400	519	487
Per capita remittance income (BDT/month)	75	86	122
Farm income (%)	47.2	38.8	48.7
Nonfarm income (%)	44.5	52.4	41.0
Remittances (%)	8.3	8.7	10.3
HHs with farm income (%)	*79.9*	*80.8*	*87.2*
HHs with nonfarm income (%)	*83.1*	*89.1*	*77.4*
HHs with both farm and nonfarm income (%)	*62.9*	*69.9*	*64.5*
Composition of household income (%)			
Agricultural production[a]	23	21	18
Livestock and fishery	10	4	14
Agricultural wage income	14	14	16
Enterprise income	15	15	13
Wage and salaried income	13	27	24
Income from miscellaneous sources[b]	17	11	4
Remittances	8	9	10

Sources: BBS, HIES 2000, 2005, and 2010.
Note: Monetary figures are consumer price index (CPI)–adjusted; 2000 = 100. BDT = Bangladesh taka; HH = household.
a. Receipt from crop, vegetable, and fruit production and other horticultural activities.
b. Receipt of self-employed professional (lawyer, doctor, tutor, and so on), rental income from properties and assets, interest and profits from savings and investments, and receipts from safety net programs, charities, and similar sources.

with farm-sourced income (income from all crops and horticulture, livestock, fisheries, and agricultural wages) increased marginally through the decade, while—surprisingly—nonfarm incomes (from all sources other than farm-related activities and remittances) fell. The relative slowdown of the nonfarm sector during 2005–10 occurred as the profitability of agriculture surged and consumer goods from urban centers increasingly replaced goods once supplied by village industries.[5] Even so, nonfarm activities remain critically important for rural households, since they account for a significant share of rural household income (41 percent).

Remittances are another major factor that has driven growth.[6] Estimates from the 2010 HIES indicate that a significant 26 percent of rural households receive remittance income, and on the whole remittances account for about 10 percent of the average rural household's income.[7] These estimates coincide closely with those from the Bangladesh Integrated Household Survey (BIHS), which shows that on average remittances constitute 13.8 percent of rural household income. The BIHS also shows that the incidence of remittances and the relative size of their contribution to household income vary significantly.

The benefits of remittances seem concentrated in particular geographical areas. The distribution of remittance amounts by administrative division, estimated in HIES 2010, shows that the vast majority of remittances were

concentrated in two divisions—Chittagong Division (42.4 percent of all remittance income) and Dhaka Division (35.0 percent). All other divisions have much lower shares, with the next largest being Rajshahi Division, at 7.6 percent.

Changing Poverty Profile

As the array of farm and nonfarm activities in rural areas grows, becoming more intricately intertwined and interdependent, the rural economic structure and its dynamics become increasingly more complex and challenging to understand. This section aims to develop a more accurate picture of the underlying dynamics and drivers of rural poverty at the household level. The starting point for the analysis is the central insight of the Poverty Assessment Report (PAR)—that growth in farm income was a powerful and unappreciated driver of poverty reduction between 2000 and 2010. Much of the ensuing discussion focuses on the considerable mobility of rural households' economic status and consequently on the need for policies and strategies that not only enable households to move out of poverty but also help them avoid repeated transitions in and out of poverty.

Evolving Endowments of Rural Households

Rural households in Bangladesh are changing in ways that are significant for agriculture. Panel data from the same set of households over 13 years show that family size has continuously fallen since 2000, while the number of income-earning members in each household has remained relatively stable, causing the dependency ratio to decline (table 2.4). Survey households also experienced a decline in the number of agricultural workers and a corresponding increase in the number of nonagricultural workers, as well as showing a significant increase in the share of female workers per household. An especially dramatic change is that the share of households headed by women doubled between 2004 and 2008.

With about 8 million hectares of arable land for about 160 million people, Bangladesh has the world's highest population density; landholdings per capita are extremely small. The decline in the size of landholdings among the panel survey households appears to have stabilized, remaining at about 0.11 hectares per capita from 2000 to 2013. For these households, the (net) area of cultivated land is even lower at 0.08 hectares per capita, but it has also remained stable. Rice area per capita is slightly higher as irrigation allows multiple crops in a year, making the gross area cultivated to be slightly higher than the net cultivated area. Farm households have not increased the area planted to high-yielding modern varieties, but given that roughly 80 percent of the area is already under modern varieties, the scope for expansion is limited.

An important change in these rural households is their growing endowment of human capital. Average years of schooling for workers in a rural household increased from 4.1 years in 2000 to 4.6 in 2013. The average level of schooling has risen for agricultural and nonagricultural workers alike. Additional schooling is thought to facilitate the transition to nonfarm work (in addition to the advantages it confers on those who remain in agriculture).

Table 2.4 Changes in Household Assets, 2000–13

Asset	*2000*	*2004*	*2008*	*2013*
Labor force				
Family size	5.40	5.23	4.94	4.43
Number of earners	1.56	1.63	1.58	1.51
Number of agricultural workers	0.89	0.93	0.84	0.63
Number of nonagricultural workers	0.67	0.69	0.73	0.88
Number of female workers	0.09	0.12	0.18	0.19
Sex of HH head (female, share)	0.06	0.07	0.14[a]	0.15
Natural assets				
Per capita owned land (ha)	0.11	0.11	0.10	0.11
Per capita cultivated land (ha)	0.07	0.07	0.06	0.08
Per capita rice area (ha, gross)	0.09	0.09	0.08	—
Per capita rice area planted to modern varieties (ha)	0.07	0.07	0.07	—
Human capital assets				
Average years of schooling of earning members	4.10	4.21	4.34	4.60
Average years of schooling of agricultural workers	3.33	3.46	3.70	3.87
Average years of schooling of nonagricultural workers	5.10	5.57	5.35	5.50
Financial assets (in 2008 BDT)				
Amount of formal institutional (bank) loans (per capita)	533.44	366.18	360.89	518.50
Amount of NGO loans (per capita)	429.27	563.32	956.40	1,588.20
Amount of noninstitutional (informal) loans (per capita)	375.56	499.63	1,070.94	1,064.30
Total amount of loan taken (per capita)	1,338.27	1,429.13	2,388.23	3,171.00
Agricultural capital (per agricultural worker)	8,158.30	8,434.42	11,757.45	—
Nonagricultural capital (per nonagricultural worker)	15,523.16	11,514.14	12,938.70	—

Sources: World Bank calculations, based on data from MH panel surveys, various years.
Note: BDT = Bangladesh taka; ha = hectare; HH = household; NGO = nongovernmental organization; — = not available.
a. HIES 2010 reports that 15.3 percent of rural households are headed by women.

Access to finance from formal financial institutions (banks) has stagnated, and over time such financing has declined in size relative to nonformal sources of credit. The size of loans per capita from nongovernmental organizations (NGOs) and noninstitutional sources (family, friends, and informal moneylenders) is now significantly larger. The rate of increase in volume per capita has been rapid for both NGO loans (almost quadrupling between 2000 and 2013) and for noninstitutional loans (tripling over the same period).

One of the most telling statistics for rural households is where they choose to invest their savings or borrowed capital, and in this regard the panel data imply that an important change is under way in rural Bangladesh. Agricultural capital per agricultural worker increased by 44 percent between 2000 and 2008,[8] even as the amount of nonagricultural capital per nonagricultural worker declined, reflecting households' continued engagement, and confidence, in agriculture. This information also reflects the increasing capital intensity of agriculture, which is consistent with the growth in agricultural mechanization. The apparent decline in capital intensity in the nonfarm sector probably reflects an increase in informal or wage labor rather than an increase in nonfarm business activities.

Changing Poverty Profile of Rural Households

Strong growth, both in the overall economy and in agriculture, has been accompanied by a significant reduction in poverty, measured by income and by significant improvements in key human development indicators (World Bank 2012). Trends and severity of income poverty in Bangladesh since 1988–89 are presented in tables 2.5 and 2.6, estimated from HIES data for 2000 to 2010. As box 2.1 explains, these trends are closely reflected in the MH panel data.

Table 2.5 Trends in Consumption-Poverty (CBN Method)

	FY 1988	*FY 1991*	*FY 1995*	*2000*	*2005*	*2010*
National						
H	57.1	58.4	53.1	48.9	40.0	31.5
P(1)	15.4	17.2	14.4	12.8	9.0	6.5
P(2)	5.8	6.8	5.4	4.6	2.9	2.0
Urban						
H	43.9	44.9	35.1	35.2	28.4	21.3
P(1)	11.1	12.0	9.2	9.0	6.5	4.3
P(2)	3.8	4.4	3.4	3.3	2.1	1.3
Rural						
H	59.2	61.2	56.6	52.3	43.8	35.2
P(1)	16.0	18.1	15.4	13.7	9.8	7.4
P(2)	6.1	7.2	5.7	4.9	3.1	2.2

Sources: Estimates taken from the HIES 2010 report and the World Bank Country Study on Bangladesh (1999).
Note: CBN = cost of basic needs; H = headcount measure; P(1) = poverty gap; P(2) = squared poverty gap.

Table 2.6 Trends in Income Growth and Inequality

	Poverty line	*Survey mean (BDT/person/month)*	*M-P ratio*[a]	*Gini index*
Rural				
1988–89	379	435	115	0.26
1991–92	469	510	109	0.25
1995–96	591	653	110	0.27
2000	635	820	129	0.27
2005	832	1,088	131	0.28
2010	1,511	2,122	140	0.27
Urban				
1988–89	454	695	153	0.32
1991–92	535	817	153	0.31
1995–96	707	1,234	175	0.37
2000	725	1,430	197	0.37
2005	949	1,808	191	0.35
2010	1,730	3,202	185	0.32

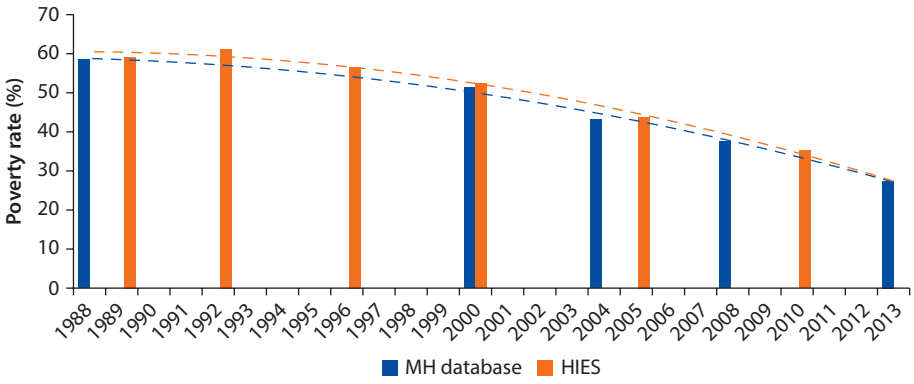
Sources: BBS, HIES 2000–10.
Note: BDT = Bangladesh taka.
a. M-P ratio is the mean as a percentage of the poverty line.

Box 2.1 Comparability of Poverty Estimates Based on MH Panel Surveys and HIES Data

The poverty ratio for the MH panel survey data is estimated using rural stratum poverty line incomes from various rounds of the Household Income and Expenditure Survey (HIES). The HIES poverty lines are based on the cost of basic needs. Poverty lines from a nearest year's HIES are updated with the rural consumer price index to match the years of the MH panel surveys. HIES uses consumption expenditure data to estimate income poverty, as consumption is considered to be a better indicator of households' permanent income status, especially in agrarian economies subject to year-to-year fluctuations in output. However, the 62-village panel survey does not collect households' consumption information; rather it focuses on their income-generating activities. An estimate of income, instead of consumption expenditure, is thus used to generate the poverty trends from the panel survey.

Because they use the same reference poverty line incomes used in HIES, the income-based poverty measures from the MH surveys provide estimates of poverty comparable to the HIES poverty measures. For example, in 2000, the poverty rate was 51 percent for the 62-village panel survey, and the matched rural poverty rate was 52 percent in HIES. The interpolation of income poverty lines for years other than HIES survey years also shows that the MH panel surveys reflect the emerging poverty picture for 2004 and 2008 with reasonable accuracy. The similarities are evident in figure B2.1.1, which plots trends in rural poverty and its evolution from 1988 to 2013. This comparability is important, as the MH panel survey data offer a unique opportunity to study the dynamics of poverty by tracing the fortunes of individual households over time. Because of this usefulness, the MH panel surveys are used extensively later in this report. For a comparison of poverty and selected indicators from the various years of HIES and the MH panel surveys, see annex 1A.

Figure B2.1.1 Evolution of Rural Poverty, 1988–2013



Sources: BBS, HIES (various years) and MH panel surveys 1988, 2000, 2004, 2008, and 2013.
Note: Dashed lines are trend lines corresponding to each series.

A brief recap of the main trends helps frame the overall progress in poverty reduction over recent years as well as highlighting the development challenge that lies ahead. First, the headcount ratio of the population living in poverty declined from 58.4 percent in 1991–92 to 31.5 percent in 2010, a reduction of 1.5 percent per year (table 2.5). Second, the pace of poverty reduction was faster in the 2000s: poverty declined by 1.75 percent per year with faster income growth (table 2.5). Third, the pace of poverty reduction was uneven between rural and urban areas. In the 1990s, urban poverty levels fell faster than rural poverty, but in the 2000s, poverty declined more rapidly in rural areas. These trends correspond closely to agricultural growth performance (shown earlier in figure 2.1). Fourth, the level of inequality, as measured by consumption expenditure distribution, shows very little change in both rural and urban areas between 1991–92 and 2001 (table 2.5). Fifth, per capita income as a ratio of poverty line income, an indicator of economic vulnerability, is much higher in urban areas, implying that urban nonpoor households are less vulnerable than rural nonpoor households (table 2.6).

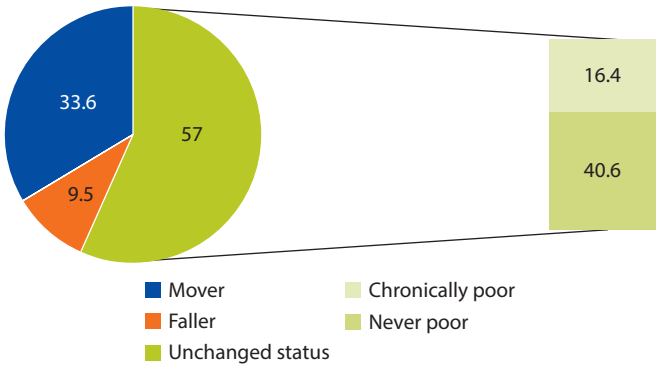
Aside from the progress in poverty reduction indicated by these income/expenditure measures, Bangladesh has also made progress based on nonincome measures, as noted in the PAR, including food security. In 2010, 38.4 percent of the population was moderately calorie deficient, down from 40.4 percent in 2005.[9] The percentage of people suffering from severe calorie deficiency declined relatively faster, from 19.5 percent in 2005 to 16.1 percent in 2010.

Yet rural poverty, even with these impressive declines, remained high in 2010 at 35.2 percent, and it is deeper and more concentrated than urban poverty. An important facet of poverty that is well recognized in the literature (Narayan, Pritchett, and Kapoor 2009; Ravallion 2001, 2005) but often insufficiently analyzed is the movement of households in and out of poverty. This churning has major implications for policy and strategy, yet it cannot be detected by looking at poverty estimates at discrete points of time, as in the figure in box 2.1 (figure B2.1.1). The figure depicts a relatively smooth decline in poverty, but in reality, the poor and the vulnerable engage in a real-life game of Snakes and Ladders; for them, pathways out of poverty are rarely linear or predictable.

Despite significant efforts and sacrifices to climb up the income ladder, many poor people are pushed back down the ladder because of multiple shocks—sudden illness or chronic poor health, deaths or disabilities of earners, natural disasters, and a multitude of other personal or impersonal misfortunes (Kabeer 2009; Narayan, Pritchett, and Kapoor 2009; Rahman and Hossain 1995). Aside from personal issues and health crises, economic and business risks are important and often underestimated risks for poor rural entrepreneurs.

The twists and turns experienced by rural households cannot be observed with cross-sectional surveys such as HIES, but as discussed in box 2.1, an important advantage of the MH panel surveys is that they track changes in households over time, especially changes in their poverty status, which allows a more robust analysis of the characteristics of the poor and the drivers of poverty. Each household can be classified into one of four groups ("dynamic poverty groups") based

Figure 2.11 Change in Poverty Status of Rural Households: End-Point Comparison between 2000 and 2013
percent



Sources: MH panel surveys.

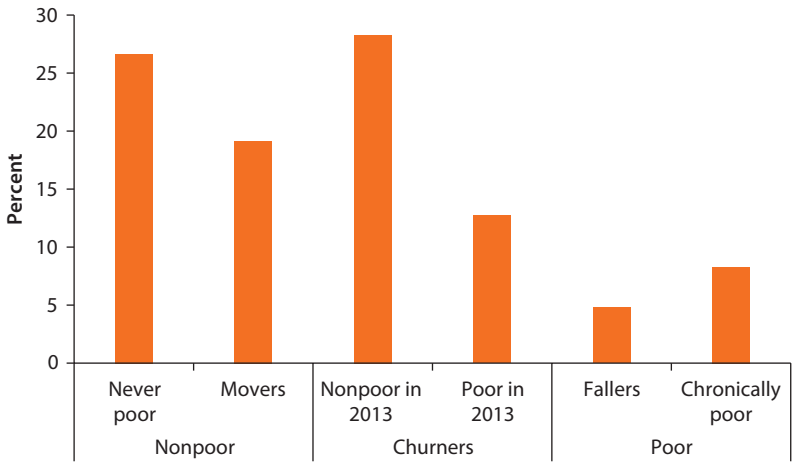
on its poverty status between any two years. For example, figure 2.11 shows the classification of households into dynamic poverty groups for the 2000 and 2013 rounds of the MH panel survey. If the sample households were not poor in each round, they were categorized as *never poor*; households that were poor in each round are categorized as *chronically poor*. Households that were not poor in the base year but had become poor by the end year were categorized as *faller households* (or *descending households*), and households with the opposite pattern were considered *mover households* (or *ascending households*).[10]

In a comparison of any two years, this classification generates a simple 2×2 table, but with multiple survey rounds, it is possible to capture a household's multiple movements across the poverty line. The most recent four rounds of MH panel data (2000, 2004, 2008, and 2013) were used in the analysis for this report[11] to examine the churning that takes places as rural households move in and out of poverty. The data track the poverty status of about 1,300 households at four points in time between 2000 and 2013.

The static (single-period) analysis shows poverty declining from about 50 percent in 2000 to 43, 38, and 26 percent in the successive survey years. A simple end-point comparison of households between 2000 and 2013 (shown in figure 2.11) shows that the majority of households (almost 57 percent of the sample) maintained the same poverty status over the entire period. Altogether, 41 percent remained nonpoor and 16 percent remained poor; of the other 43 percent, about 34 percent had climbed out of poverty by 2013, while 10 percent had fallen into poverty. This simple analysis presents a generally positive picture.

Yet when changes in households' poverty status over the intervening two years are taken into account, a much more complex and dynamic picture of rural vulnerability emerges (figure 2.12). Households' fortunes follow myriad trajectories through time, and the majority of the sample risks falling into poverty in any given year. Figure 2.12 shows the distribution of households in 2013 based

Figure 2.12 Evolution of Rural Poverty: Churning from 2000 to 2013



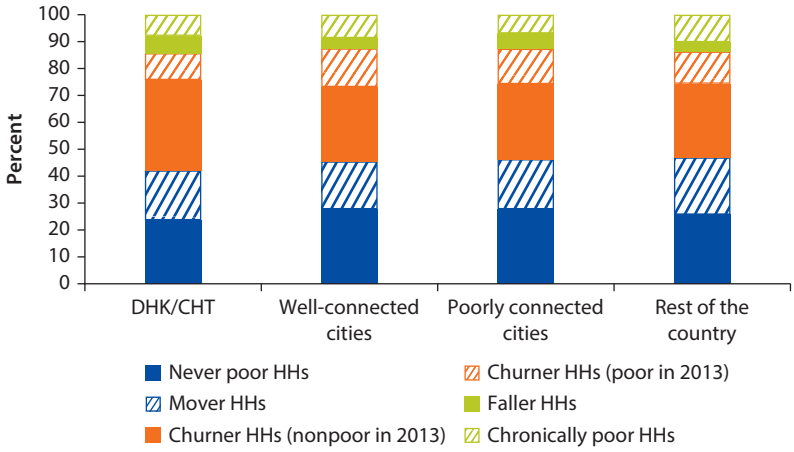
Source: World Bank calculations based on MH panel survey data for 2000, 2004, 2008, and 2013.

on their poverty status in each of the previous rounds of surveys (2000, 2004, and 2008). Thus, among the households that were nonpoor in 2013, only 27 percent managed to stay out of poverty throughout the entire 13 years. Of the 26 percent that were poor in 2013, the share of chronically poor households (that is, those that were poor in each of the survey years) was 8 percent, 5 percent had fallen into poverty at some point between 2000 and 2013 and stayed poor, while 13 percent were "churners" who had experienced at least one period above the poverty line but had fallen back under the line by 2013.[12] About 19 percent of households had climbed out of poverty since 2000, but a substantial 28 percent that were not poor in 2013 had endured at least one period of poverty in the previous three rounds. Such households are clearly vulnerable to falling back into poverty.

For the households in the panel survey, it is possible to look at how poverty status changes not only over time but also in different geographical settings. Understanding the spatial dimensions of poverty and vulnerability is essential to devise appropriate strategies to tackle the remaining poverty and vulnerability challenges in rural Bangladesh and guide decisions on public investments and other public policies.

Proximity to urban centers and the potential for households to connect to those centers (via roads, for example) are two key geographical features that are likely to influence poverty dynamics. To explore this poverty-urbanization nexus, the sample is divided into four groups by district as follows: households in districts adjacent to Dhaka and Chittagong; districts adjacent to secondary cities and with good road connectivity (Bogra, Comilla, Mymensingh, and Sylhet); districts adjacent to secondary cities but with poor connectivity (Barisal, Jessore, Khulna, Rajshahi, and Rangpur); and the remaining districts, which are mostly rural or adjacent to smaller cities.

Figure 2.13 Spatial Dimension of Poverty Dynamics



Source: World Bank calculations based on MH panel survey data for 2000, 2004, 2008, and 2013.
Note: CHT = Chittagong; DHK = Dhaka; HH = household.

Figure 2.13 shows the share of households by dynamic poverty group (never poor, movers, churners who were nonpoor in 2013, churners who were poor in 2013, fallers, and the chronically poor) in each of the four groups of districts. The size of the poverty groups is broadly consistent across the four spatial settings, although the static share of all nonpoor in 2013 (the sum of never poor, movers, and churners who were among the nonpoor in 2013) is marginally higher near the megacities of Dhaka and Chittagong than in the rural areas. Yet while the bright lights of the megacities attract a substantial share of households, such households face greater vulnerability. The share of churners is higher near the megacities than in rural areas, and the share of the nonpoor who are churners (in other words, who remain vulnerable) is much higher near the megacities.

For households near secondary cities, connectivity makes a substantial difference. Smaller cities that are well-connected to the rest of the country have the highest share of households that have never been poor and the lowest share of churners (especially among those who were nonpoor in 2013).

These findings confirm that progress has been made in reducing poverty, but by revealing the large share of the rural population that remains highly vulnerable to falling into poverty, they serve as a warning against complacency.[13] They also have several implications for policies and strategies to reduce vulnerability and foster sustained poverty reduction. Both policy and strategic attention need to be broadened to include the significant share of the population that lies just above the poverty line, and improved connectivity and the economic development of secondary and tertiary cities should be high priorities. Finally, the significant mobility across poverty lines (in both directions) suggests caution in using static indicators of poverty for profiling the poor and drawing conclusions on proximate drivers—a challenge taken up in the next two sections of this chapter.

Socioeconomic Characteristics of the Dynamic Poverty Groups

Table 2.7 uses the dynamic classification of poverty to compare changes in socioeconomic characteristics and asset endowments across poverty groups. All income and asset values are measured in constant 2008 prices (for comparability) and on a per capita basis (to take account of changing household sizes over time). The analysis is restricted to the years 2000 and 2008 for several practical reasons: it makes the analysis more current,[14] the 2013 survey provides less comprehensive information for the sample, and using the 2000 and 2008 data makes it possible to maximize the number of households included in the panel (about 1,600).

Table 2.7 Changes in Assets by Dynamic Poverty Group, 2000–08

	Never poor HHs		*Faller HHs*		*Mover HHs*		*Chronically poor HHs*	
Asset	*2000*	*2008*	*2000*	*2008*	*2000*	*2008*	*2000*	*2008*
Labor force								
Family size	5.04	5.12	4.86	5.28	5.29	4.63	5.23	5.35
Number of earners	1.54	1.73	1.51	1.49	1.40	1.69	1.32	1.47
Number of agricultural workers	0.76	0.77	0.77	1.01	0.81	0.89	0.80	0.94
Number of nonagricultural workers	0.78	0.96	0.74	0.47	0.58	0.80	0.52	0.53
Number of female workers	0.12	0.20	0.09	0.13	0.06	0.20	0.09	0.14
Sex of HH head (female, %)	6.63	13.60	7.14	11.20	5.87	14.00	5.66	10.80
Natural assets								
Per capita owned land (ha)	0.21	0.20	0.09	0.06	0.06	0.09	0.03	0.03
Per capita cultivated land (ha)	0.12	0.10	0.07	0.05	0.05	0.06	0.04	0.04
Per capita rice area (ha, gross)	0.15	0.12	0.09	0.06	0.06	0.07	0.05	0.05
Per capita rice area planted to modern varieties (ha)	0.11	0.11	0.07	0.05	0.04	0.06	0.03	0.04
Human capital assets								
Average years of schooling of earning members	6.10	6.18	3.91	4.09	3.32	3.81	2.47	2.62
Average years of schooling of agricultural workers	4.97	5.31	3.15	3.87	2.97	3.18	2.12	2.28
Average years of schooling of nonagricultural workers	7.41	6.96	5.07	4.90	3.73	4.82	3.26	3.35
Financial assets (2008 BDT)								
Institutional loan (per capita)	1,767.0	2,083.0	801.8	875.4	646.5	1,218.0	470.6	811.1
NGO loan (per capita)	480.3	1,078.0	502.3	732.5	479.5	1,125.0	340.8	738.2
Noninstitutional (per capita)	505.9	1,623.0	733.3	1,840.0	225.8	633.3	182.9	330.8
Total loan taken (per capita)	2,273.0	3,707.0	1,535.0	2,716.0	872.3	1,852.0	653.5	1,142.0
Agricultural capital (per agricultural worker)	11,392	15,183	8,526	11,089	5,583	10,139	5,239	10,766
Nonagricultural capital (per nonagricultural worker)	33,685	28,375	17,735	6,042	3,039	11,552	1,662	1,760
Total capital (per worker)	53,298	45,385	28,818	17,571	10,204	22,083	8,126	13,894

Source: World Bank calculations based on MH panel survey data for 2000 and 2008.
Note: BDT = Bangladesh taka; ha = hectares; HH = household; NGO = nongovernmental organization.

Several aspects of the comparison are revealing. First, poverty status is closely related to the number of workers in a household. Households that have never been poor have the most workers; chronically poor households have the fewest. Ascending households gained workers even as their family size fell, whereas descending households lost workers despite an increase in family size—in other words, their economic dependency ratio rose rapidly. As more women started to participate in the workforce, the number of overall earners increased. Numbers of working women expanded in all four dynamic poverty groups, with the largest increase occurring among mover households, followed by the never poor. The number of workers increased modestly in chronically poor households, but the benefits were limited by the high average family size of these households (relative to all other groups), which increased over time. Progress in reducing fertility clearly helped a substantial proportion of households to reduce their number of dependents in relation to their number of workers and realize a "demographic dividend" in the form of higher per capita income and lower poverty.

A second important observation is that rural households must rely upon multiple income strategies, on and off of the farm, to improve their welfare, especially because most have only a limited and declining amount of land at their disposal. Nonfarm sources of income have been important for the never poor and the mover households, as indicated by the growing number of nonagricultural workers in those households (although they also gained more agricultural workers, albeit more slowly). The faller households maintained their average number of earners, but in those households the number of nonagricultural workers shrank, while the number of agricultural workers expanded. At the same time, the share of land owned and planted by faller households declined. As discussed later in relation to changes in households' sources of income, agriculture can be an important safety net for households that lose other sources of income, but in a context where the productive asset base (the availability of land) is declining rapidly, households struggle to compensate for a large loss in nonagricultural income.

Third, as expected, never poor households had the most natural assets, followed by (in order) the ascending, descending, and chronically poor households. The chronically poor had the lowest endowments of every type of asset—the fewest earners per household, fewest average years of schooling among earners, poorest access to a credit market, and lowest ownership of fixed capital other than land. Land ownership increased substantially among mover households but decreased sharply among falling households (the other two categories changed little or not at all). Notably, the asset base of the faller households was higher than that of the mover households at the start of the period.

The loss of natural assets by descending households and the gain by ascending households is important information about poverty dynamics in rural Bangladesh. Table 2.8 shows the extent to which land ownership influences the likelihood of escaping from poverty (for convenience, the analysis used the 2000 endowment of land and four categories of land size). The proportion of households that escaped from poverty—the exit ratio—was highest (76 percent) for the medium

Table 2.8 Change in Poverty Status by Land Ownership, 2000–08
percent

Land ownership in 2000	*Never poor HHs*	*Faller HHs*	*Mover HHs*	*Chronically poor HHs*	*Exit ratio*	*Vulnerability ratio*
Absolute/functionally landless (≤0.20 ha)	21.01	11.19	27.92	39.87	41.2	34.8
Marginal landowner (0.21–0.40 ha)	36.84	13.36	29.15	20.65	58.5	26.6
Small landowner (0.41–1.00 ha)	45.34	17.04	22.51	15.11	59.8	27.3
Medium/large landowner (>1.00 ha)	76.52	8.50	11.34	3.64	75.7	10.0
All	*36.75*	*12.25*	*24.50*	*26.50*	*48.0*	*25.0*

Source: Based on MH panel survey data for 2000 and 2008.
Note: Exit ratio = Col 4/(Col 4+Col 5)*100. Vulnerability ratio = Col 3(Col 3+Col 2)*100. ha = hectares; HH = household.

and large landowners, followed by small and marginal landowners (about 60 percent each) and the absolutely or functionally landless (41 percent). Households with more land were able to exit from poverty more often, and those with no land faced the highest odds.

The vulnerability ratio—the proportion of nonpoor households that subsequently became poor—is also sensitive to the initial asset position. The vulnerability ratio is highest for the landless (35 percent) and lowest for larger landowners (10 percent). Analysis over the extended period from 1988 to 2008, however, shows an improvement; vulnerability declined across all household groups in the 2000s compared to the 1990s—it was near 67 percent in the 1990s for the marginal landowners but fell to less than half of that in the 2000s (Sen, Ahmed, and Gautam 2015).

The fourth important observation from the comparison of changes in socioeconomic characteristics and asset endowments for the dynamic poverty groups is the high degree of inequality in the distribution of human capital. Human capital is widely acknowledged to be a critical source of income growth with significant potential to trigger improvements in economic and social well-being. The panel survey data reveal that initial human capital endowments—measured as the average years of schooling for earners—were twice as high for never poor households compared to chronically poor households. While the human capital of rural labor increased across all four dynamic poverty groups, it improved most rapidly among the ascending households.

In sum, investments in natural assets (land ownership) and human capital (educational attainment of household members) are demonstrably important for rural households' poverty dynamics in Bangladesh. These assets are expected to translate into physical capital (equipment, machinery, and other forms of physical business investments); in the data examined here, however, changes in the average value of capital per worker show varying trends. Total capital per worker fell for the never poor and faller households but increased for the riser as well as the chronically poor households. The compositional shifts show that the decline

in the total capital per worker for the nonpoor was driven by a decline in nonagricultural capital, even as agricultural capital increased. Faller households saw a sharp fall in nonagricultural capital, which is consistent with the falling number of nonagricultural workers and suggests that such households have withdrawn from nonagricultural activities. Mover households, on the other hand, substantially increased both forms of capital, as did the chronically poor. The mover households increased their investment relatively more in nonagricultural capital, whereas the chronically poor invested more in agricultural capital.

Drivers of Rural Poverty

The descriptive analysis provides much insight into the dynamics of rural poverty in Bangladesh between 2000 and 2008, but being correlational at best, it cannot indicate causal relationships or clearly identify drivers of poverty. Statistical analysis of the panel survey data helps to identify characteristics that potentially distinguish the movers from the chronically poor, as well as features that distinguish households that fell into poverty from households that did not.

The probability that poor households will move out of poverty and that nonpoor households will subsequently fall into poverty is modeled over the two subperiods for which data are available—2000–04 and 2004–08—in addition to the longer-term outcomes between 2000 and 2008. A number of potential correlates are included in the analysis, based on the data and the literature, including household demographic characteristics, physical and human capital endowments, migration of household members, occupational structure, and access to financial services and infrastructure. To avoid potential endogeneity problems, only base-year values of explanatory variables are used for each period to explain the change in poverty status between the two periods. Annex 2A, table 2A.1 provides the regression results for the mover versus the chronically poor households; table 2A.2 shows the results for the faller versus the never poor households.

Results for the movers and fallers very consistently highlight the roles of particular factors in transitions into and out of poverty. The results are also consistent with the varying roles of farm and nonfarm income drivers between the early years of the 2000s (2000–04) and the later years (2004–08). Household size and number of workers helped the movers, although the role of these factors in preventing the downward mobility of fallers was limited and is significant only for the full period. Age of household head, reflecting life-cycle effects, helped households with older heads to avoid falling into poverty but shows only weak effects for upward mobility.

Land ownership is especially significant for preventing households from declining into poverty (consistent with land's importance as a determinant of poverty, as discussed in the descriptive analysis). Similarly, human capital (the average years of schooling of earners) plays a strong, positive role in helping households to move out of poverty and in preventing them from falling back. Migration, especially foreign migration, is strongly correlated with moving out of poverty, and between 2004–08 it helped households avoid falling into poverty.

For the most part, however, no significant correlation emerges between sector of work and the dynamics of poverty. (The indicator includes all household members and is based on the type of activity in which the largest share of the household's collective time is spent—farm, nonfarm, or both.) For households engaged only in farming, the probability of the poor rising out of poverty fell and of the nonpoor falling into poverty increased during 2000–04. This is consistent with the poor performance of agriculture in the early 2000s, as discussed elsewhere in this report. The same conclusions emerge for the roles of agricultural and nonagricultural capital (per worker).

Being located farther from Dhaka reduced the probability that a household would rise out of poverty and also increased its chances of falling into poverty, highlighting the importance of access to services, markets, and connectivity for poverty outcomes. Interestingly, over the long run households in western Bangladesh (as indicated by the East-West indicator) had a higher probability of rising out of poverty, although the effect of location was not significant in either of the two subperiods. Being located in western Bangladesh is consistently significant in preventing people from falling into poverty, however, indicating that the particular economic characteristics of western Bangladesh require further study. Other factors, such as population density and urbanization, did not appear to be significant determinants of poverty.

The main message emerging from the analysis of poverty dynamics is that while all routes mattered in determining poverty outcomes, some mattered more than others in a particular subperiod. The longer-term analysis suggests that different factors were structurally transformative in different subperiods.

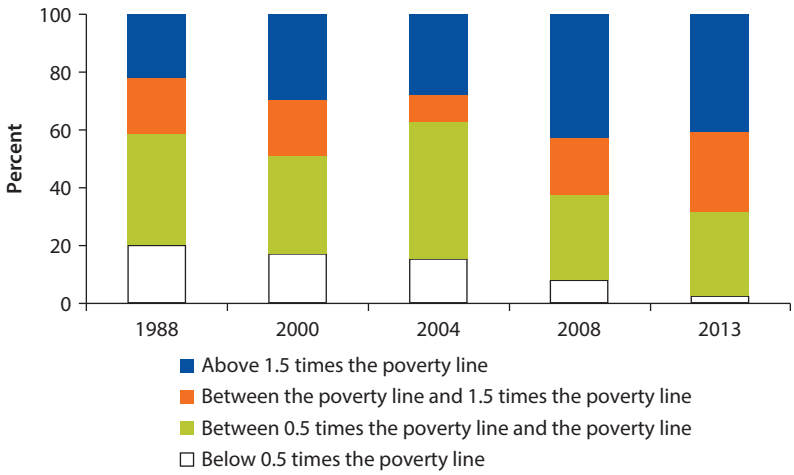
Patterns and Drivers of Income Growth of Rural Households

The panel survey data provide a unique opportunity to identify the role of different sources of income growth in different types of households. The previous analysis of poverty dynamics classified households into simple poor/nonpoor categories. For this analysis, a slightly finer grid was used to categorize sample households into four groups, based on their poverty status in the particular survey year, and using the poverty-line incomes from HIES:

- ***Nonpoor:*** Monthly per capita incomes more than 1.5 times the poverty-line income.
- ***Vulnerable:*** Monthly per capita income between the poverty line and 1.5 times the poverty-line income (reflecting the higher risk of falling into poverty).
- ***Poor:*** Monthly per capita income less than the poverty line but above half of the poverty line.
- ***Extremely poor:*** Monthly per capita income less than half of the poverty line.

Figure 2.14 shows the distribution of the sample households by their poverty status for all years in which the panel survey was done. The long-term decline in poverty among the sample households resembles the decline seen in successive HIES.

Figure 2.14 Distribution of Households by Poverty Status, 1988–2013



Sources: World Bank calculations using MH panel surveys.

Consistent with trends observed in the HIES data, the panel survey data show that headcount poverty rose in 2004 (mostly in the poor group, but not in the extremely poor group) and then fell sharply in 2008. A major flood in 2004, which affected a very large part of the country and its population, may explain the rise in poverty that year. The poverty reduction trend appears to have continued in 2013, although the data also suggest that the number of vulnerable households rose slightly.

The recent rate of poverty decline is impressive, yet a significant proportion of households still remains below the poverty line. One-third of nonpoor households remain vulnerable, with income levels within a 50 percent margin of the poverty line. Such households have a high risk of descending into poverty following a natural disaster, serious illness, economic loss, or other type of shock.

Further insight into patterns of poverty and income dynamics is gained when the analysis is confined to the 2000, 2004, and 2008 rounds of the MH panel surveys. Data from those three rounds are more recent and therefore more pertinent to current policy concerns (1988 may be too far back in time); they also provide the largest sample of panel households (1,600) for the analysis. The 2013 survey collected only limited information on income by source. Note that the panel of households used for the analysis has a similar distribution by poverty profile as the full sample from all survey rounds (annex 2A, table 2A.3).

The classification of households by economic stratum and average real per capita annual income confirms that some groups of households experienced remarkable upward income mobility (table 2.9). Households that were extremely poor in 2000 more than tripled their average income over the eight-year period (income for these households rose rapidly to 2004 and continued to rise after that).

Table 2.9 Average Real Per Capita Income for Survey Households in 2000, 2004, and 2008
2008 BDT

	HH income group	*2000*	*2004*	*2008*
2000	Extremely poor	4,052	9,983	12,290
	Poor	8,708	14,192	16,235
	Vulnerable	14,443	17,204	18,788
	Nonpoor	36,775	30,980	32,645
2008	Extremely poor	11,373	11,082	4,277
	Poor	11,820	11,644	8,908
	Vulnerable	13,389	15,040	14,052
	Nonpoor	24,754	28,213	36,857

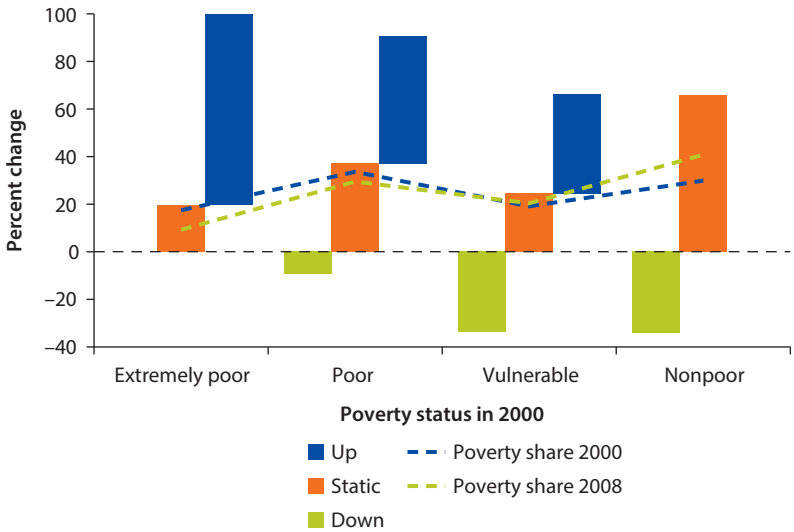
Source: World Bank calculations using MH panel surveys.
Note: The shaded cells show the average real per capita income of households in each economic stratum in 2000 and 2008. BDT = Bangladesh taka; HH = household.

Similarly, households that were poor in 2000 had more than doubled their average real income per capita by 2008. Even the vulnerable group, on average, saw an increase in income. On the other hand, households that were extremely poor in 2008 had reported much higher incomes in 2000, indicating that significant shocks and the associated decline in income had precipitated a sharp descent into poverty. A similar but less pronounced pattern is observed among poor households, while the nonpoor on average maintained high incomes and marginally improved them.

When the average real per capita incomes of households in each economic stratum in 2000 and 2008 (the shaded cells in table 2.9) are compared, relatively little appears to have changed in the intervening years. Extremely poor and poor households attained minor increases in income, but incomes for vulnerable and nonpoor households stagnated, suggesting some improvement in the incomes of the poor but not the nonpoor. Clearly the static snapshot by poverty status is a dramatically different picture than the dynamic picture that emerges from observing the same households at different points in time.

Household income can move both up and down. A sense of the degree of mobility can be gained from the panel of 1,600 households in the longitudinal survey. Figure 2.15 shows the mobility of those households between 2000 and 2008. The trends in the figure confirm that although the average proportion of impoverished households in the two years (shown by the two lines) appears to have changed relatively little, households below the poverty line experienced significant upward mobility between 2000 and 2008. Incomes rose for the majority of households that were extremely poor and poor in 2000, allowing many to escape poverty by 2008 (the next paragraph presents the detailed numbers). Even a substantial share of vulnerable households improved their economic status. By definition, upward mobility of the highest income group is ruled out, but a majority of nonpoor households (two-thirds) maintained their status. Even so, these positive developments must not obscure the fact that economic

Figure 2.15 Household Income Mobility, 2000–08



Source: World Bank calculations using MH panel surveys.

status fell for a nontrivial share—one-third—of households in the vulnerable and nonpoor groups.

How did those changes in household income translate into changes in poverty status? The detailed dynamics are captured in annex 2A, figure 2A.1. A substantial two-thirds of the households that were extremely poor in 2000 had attained a higher income status by 2004, and another 15 percent had moved out of extreme poverty by 2008. As a result, only 1 in 5 extremely poor households remained in extreme poverty by 2008, while 1 in 3 had exited poverty altogether. Among the moderately poor households of 2000, a substantial 55 percent had exited poverty by 2008—but about 9 percent had descended into extreme poverty. One-third of the households that were vulnerable in 2000 had descended into poverty by 2008, while 42 percent had moved up into the nonpoor category. Even some households that were not poor in 2000 became poor later; by 2008 almost 20 percent had slipped into poverty, and about 4 percent had fallen into extreme poverty.

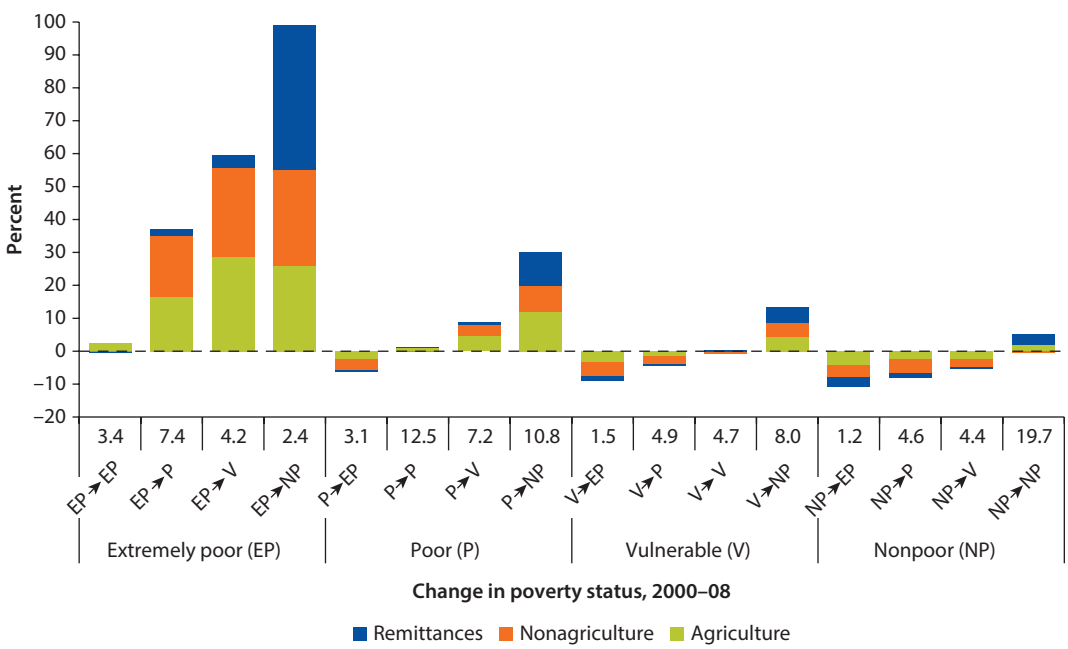
Income Dynamics and Poverty

Given the significant heterogeneity across households, and the extent of economic mobility experienced by households, looking beyond the sample averages will provide a better understanding of the performance of households in different strata and their main sources of income. The income-poverty dynamics for rural households between 2000 and 2008 can be analyzed based on the two categorizations of households—by their static poverty status and their dynamic poverty status.

Using the ex ante poverty status (the poverty status of the panel households in 2000), figure 2A.2 in annex 2A shows that for households with the highest income growth between 2000 and 2008—the extremely poor and moderately poor households—both agricultural and nonagricultural income contributed significantly to rising incomes. The implication is that those households benefited from following multiple pathways out of poverty. (Remittances also contributed to rising incomes among those households, but they played a minor role.) Agricultural and remittance income made the greatest contribution to income growth for poor and vulnerable households, with agricultural income contributing the largest share of income gains for the poor. Remittances were the major driver of income only for nonpoor households. For the nonpoor households, gains from agricultural income were small, and nonagricultural incomes actually declined.

Figure 2.16 shows the sources of income that contributed to the mobility of households classified by dynamic poverty group. The x-axis shows each group's mobility from original (2000) to final (2008) poverty status. For example, extreme poverty to extreme poverty (EP→EP) represents households that were extremely poor in 2000 and remained extremely poor in 2008, extreme poverty to nonpoor (EP→NP) represents households that moved from extreme poverty in 2000 to nonpoor status in 2008, and so on. Next to the x-axis is the percentage of the sample in each transition category; hence 3.4 percent of EP households

Figure 2.16 Contributions of Agricultural, Nonagricultural, and Remittance Income to Households' Movement in and out of Poverty, 2000–08



Source: World Bank calculations using MH panel surveys.

never left the EP category between 2000 and 2008, whereas 2.4 percent made the leap from EP to NP status. The height of the stacked bars shows the percentage improvement in per capita household incomes. As noted, most extremely poor households exhibited upward mobility. The 2.4 percent who had leapt into nonpoor status by 2008 made significant gains in income from all three sources, with the biggest contribution coming from remittances. For all other groups, agriculture was the main contributor to income growth.

Among poor households that exhibited upward mobility, agriculture provided the largest share of income, with a relatively smaller contribution from nonagricultural income. Remittances played a minor role in the income of poor households, except for those that managed to escape poverty, for whom remittances made a significant contribution.

About two-thirds of the nonpoor households in 2000 maintained their economic status through 2008, while about one-fifth had descended into poverty. Remittances were the major source of income for households that maintained their nonpoor status.

Analysis of the panel survey data confirms that agriculture has been a major driver of poverty reduction since 2000 (the main conclusion of the PAR), but it also shows that no single source or sector—no proverbial "silver bullet"—stands out as the dominant means of reducing poverty. Households rely on multiple sources of income, implicitly recognizing that a multifaceted strategy is the prudent one for climbing out of poverty. Among all sources of income, remittances helped only a few households to advance their economic status dramatically. The households that appear to have gained the most from remittances were not poor.

In their more detailed analysis of income sources, Ahmed and Gautam (2015) consistently find that on average and at the aggregate level, upwardly mobile households rely on multiple sources of income. The average and aggregate figures mask variations among regions and households, however, so that while the share of remittances is large on average across households, only a relatively small percentage of households saw extraordinary gains from remittance income. Clearly, remittances are an important potential driver of incomes and poverty reduction, but not many households have been able to pursue this strategy. A surprising finding is that incomes from trade, business, and services did not make a positive contribution to income growth for most households. For the households that descended into poverty over 2000–08, nonagricultural incomes fell sharply, while agricultural incomes did not grow fast enough to compensate for the loss.

The drivers of income growth also vary considerably across the six divisions of Bangladesh. Remittances were the main driver of income growth in Chittagong and were significant in Sylhet and Dhaka. In the other three divisions, agriculture was the main driver of income growth. Nonagricultural income (from business, services, and wage labor) was the major driver only in Sylhet. Growth in noncrop income (from livestock, fisheries, and forestry) made the greatest contribution to growth in agricultural income across all divisions, while income from labor

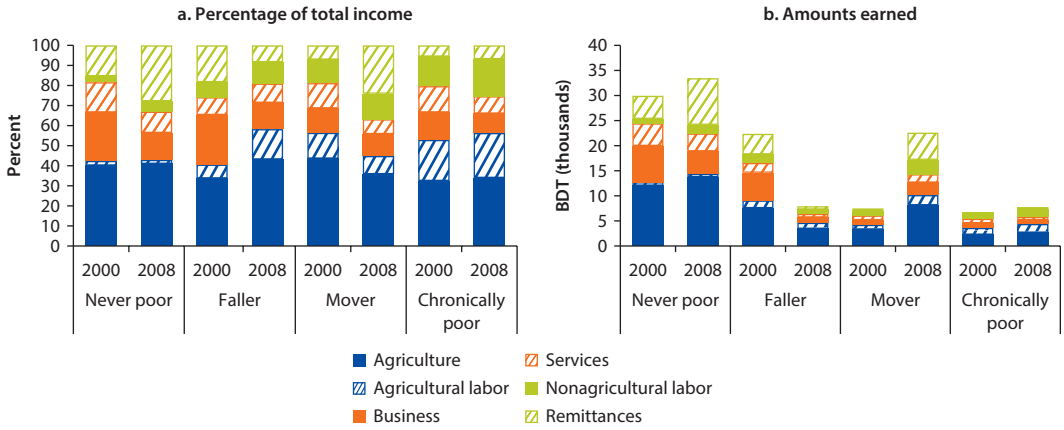
dominated growth in nonagricultural sources of income. Remittances provide a substantial increase in income on average, but they also reflect the highly unequal access across geographical locations to this opportunity for income growth.

How do these various findings, and those of the PAR, square with the general conclusions drawn from static poverty profiles, which show how various sectors (agriculture, business, services, remittances, and so on) contributed to the total income of poor households *at the time of a specific survey*? A static analysis shows what the poor currently do, but not how they got there. Given the considerable income and occupational mobility of these households, a static analysis may be misleading, as the findings of the longitudinal panel survey indicate.

Figure 2.17 helps to illustrate this point. The left panel shows the static income profiles for households by dynamic poverty group at the start and end of the analysis (in 2000 and 2008). The poor consistently obtain a higher share of their overall income from agriculture at the start, and the share of income from agriculture is even higher among those who are poor at the end of the period. The strong correlation between agriculture and poverty apparent in the left panel leads to the general conclusion that poverty is synonymous with a livelihood in agriculture.

This conclusion may be erroneous, however, at least for the sample at hand, as seen in the right panel of figure 2.17. The right panel shows the composition of per capita household incomes in *monetary levels* rather than in percentage terms. Households that were never poor clearly continued to have a high share of income from agriculture—in fact, a higher share than the other household groups. Movers benefited from an increase in all sources of income, although the growth in remittance income was much faster for these households than other

Figure 2.17 Income Sources for Dynamic Poverty Groups as a Percentage of Total Income and in Amounts Earned, 2000 and 2008



Source: World Bank calculations using MH panel surveys.
Note: BDT = Bangladesh taka.

nonfarm sources of income. Agricultural incomes again grew faster than nonremittance, nonfarm incomes. An even more important observation is that households that fell into poverty lost income across the board, especially nonfarm income, which saw the largest percentage decline. As a result, ex post, agriculture's share of "faller" households, and by definition of the ex post poor, appears higher. These dynamics illustrate agriculture's function as a safety net: when households lose other sources of income, for whatever reason, they tend to fall back on agriculture.

Drivers of Rural Incomes

A dynamic earnings function helps to determine which factors may explain the changes in household incomes (note that the analysis helps to identify factors correlated with income growth, which should not be interpreted as causes of income growth). Both the initial conditions (household characteristics) and changes in key household characteristics are used to explain the changes in per capita household income growth.[15] Given the seemingly different trajectories of households in different poverty strata, the analysis is done for the full sample and for each of the four groups of households classified by its 2000 poverty status. For detailed results, see the discussion in Ahmed and Gautam (2015); for the main results, see annex 2A, table 2A.4. The key findings are summarized here.

Older households (which had fewer young, nonworking dependents) experienced faster growth. This finding is consistent with the negative impact of household size on per capita income growth.

Ownership of agricultural land (both initial holdings and the change over time) is strongly positively correlated with income growth. As may be expected, the returns to land vary inversely with poverty status, reflecting the initial land ownership patterns.

Investment in human capital, using the average years of education of household workers (other than the household head) as a proxy, is strongly correlated with per capita income, and the estimated impact of an additional year of schooling is consistent across poverty groups and initial education levels. The education level of the household head in the base year is also included and shows a positive correlation with income, but it seems to matter more for the nonpoor. Clearly investments in education are important irrespective of the initial endowment of household capital (as embodied in the household head's education level).

Both agricultural and nonagricultural capital appear to have a significant role in households' earnings. Nonagricultural capital has a larger marginal impact, as may be expected. Nevertheless, the positive sign on agricultural capital across the income strata indicates that investment in agriculture, as for example evidenced by mechanization, is positively and strongly correlated with incomes.

A key set of findings relates to households' labor force participation. Increased participation in nonfarm work is strongly correlated with higher incomes, highlighting the importance of nonfarm work and income diversification. Income from nonfarm work is especially crucial for the extremely poor, who are more

likely to be landless or to have very small farms. In general, the findings from the regression analysis support the conclusions from the earlier descriptive analysis that households with multiple income-earning strategies tend to do better than those relying primarily on agriculture.

The descriptive analysis shows that both domestic and foreign migration appeared to be important drivers of income growth in the last two decades. In the regression results, domestic and foreign migration both appear with positive coefficients, but the domestic migration coefficient is not statistically significant. Sending a household member abroad could raise per capita earnings by 76 percent on average, yet only a small minority of households participates in foreign migration owing either to the initial costs or risks involved. The results (which capture the marginal impact) clearly show that those who do participate benefit greatly—a result consistent across all poverty status groups.

Female participation in the workforce significantly raises household earnings. Households with females who participate in the workforce earn, on average, 14 percent more than households with females who do not participate. This finding is important for rural Bangladesh, where female labor force participation is still around 25 percent. Empowering and creating incentives for more females to join the workforce would raise per capita earnings significantly.

Farm-Nonfarm Linkages and the Role of Agriculture

The main message from the analysis of macro- and micro-level data is that households have diversified their income-earning strategies and have successfully used those diverse strategies to pull themselves out of poverty. Some sources of income have mattered more in particular periods than in others, as clearly seen in the analysis of HIES data (2000–05 and 2005–10) and the MH panel survey data (2000–04 and 2004–08). Progress in reducing poverty appears to have continued to 2013, as indicated by the 2013 panel survey data—a trend that needs to be confirmed with nationally representative data. The farm and nonfarm sectors have strong roles in household employment and incomes, however, and are expected to remain key determinants of further progress in poverty reduction and shared prosperity.

As important as the farm and nonfarm sectors of the rural economy may be in their own right, it is vital to recognize their considerable interdependence and critical roles in accelerated and robust structural transformation. Agriculture has traditionally dominated the rural economy, and the importance of agricultural linkages in driving development, especially in the rural nonfarm economy, has long been recognized at the global level and in Bangladesh (see annex 4A). The agricultural sector's superior performance in recent years has helped reduce poverty rapidly, amply demonstrating its continuing pivotal role in development. In fact agriculture's role has been significantly larger than is apparent only from its direct contribution to household incomes and poverty reduction.

These conclusions are highly relevant to the debate on whether agriculture has a continuing role to play in Bangladesh's development or is destined to be a sunset industry. Given the power of rapid economic growth to lift populations

out of poverty, one view is that it is wasteful to devote any resources to a sector that will inevitably grow relatively more slowly into the future. The contrary viewpoint is that the same argument applied more than 40 years ago and logically should apply even more today, when agriculture's share in GDP has almost halved (from about 37 percent in 1973 to just 19 percent in 2012). Yet recent experience in Bangladesh has shown agriculture to be the main driver of poverty reduction.

Another point relevant to the debate—and supported by considerable evidence—is that overall economic growth continues to be significantly influenced by what happens in agriculture. Considering a simple bivariate relationship, the elasticity of overall GDP growth to agricultural growth is very high at about 0.48, with approximately 53 percent of the variation in overall economic growth explained by the variation in agricultural growth alone.[16] With an average share of 27 percent over the period, agricultural growth's contribution to GDP growth measured as a share is only 15 percent, which implies that the indirect contribution of agriculture is roughly three times higher than its directly observed share in aggregate growth, indicating very high indirect linkage effects with the rest of the economy.

This simple diagnostic is consistent with Razzaque and Raihan's (2012) separate and rigorous empirical examination of the long-run relationship between sectoral outputs. Using time-series data and a suitably adapted and extended dual-sector analytical framework to examine multiple intersectoral linkages, Razzaque and Raihan find a strong and robust externality effect of agriculture on overall GDP and other sectors. The analysis, which gives particular attention to intersectoral linkages involving agriculture, manufacturing, and services, indicates that these components of GDP move together and form a valid long-run relationship. The effects of agriculture on services are quite large, and there is evidence that agricultural growth causes outputs in other sectors.

At the micro level, strong empirical evidence has emerged recently on agriculture's multiplier effects, suggesting that through intricate farm-nonfarm linkages, agriculture has and will continue for some time to have a major indirect role in spurring rural nonfarm incomes and growth. Khandker and Samad (2014) use HIES data to convincingly show the strong and positive role of agriculture as a driver of nonfarm income.[17] They find that a 10 percent increase in farm income growth increases nonfarm income growth by 6 percent, implying a high elasticity of nonfarm growth to farm income growth (table 2.10). Khandker and Samad also apply this methodology to the more poverty-focused longitudinal survey (the WBI panel of about 1,600 households between 1991–92 and 2010–11) and find a similar effect.

Another study provides insights into the impacts of agricultural productivity on employment growth and structural transformation of nonfarm activities. From several sources of official data,[18] Shilpi and Emran (2015) create a unique set of panel data at the *upazila* (subdistrict) level. Using rainfall as an instrument for agricultural productivity, Shilpi and Emran find that growth in agricultural productivity has significant positive impacts on the growth of employment in

Table 2.10 Role of Farm Income Growth in Nonfarm Income Growth
dependent variable log nonfarm income in BDT per year

Explanatory variable	*HIES data (N = 9,134) upazila FE with IV*	*Panel data (N = 1,590) HH FE with IV*
Year is 2005 (1 = yes, 0 = no)	2.792 (0.37)	n.a.
Year is 2010 (1 = yes, 0 = no)	2.544 (0.34)	n.a.
Year is 1998–99 (1 = yes, 0 = no)	n.a.	0.837 (0.93)
Year is 2010–11 (1 = yes, 0 = no)	n.a.	1.847 (0.76)
Log farm income (BDT/year)	0.573** (2.23)	0.525* (1.82)
R^2	0.111	0.158
Endogeneity test for endogenous regressors	$\chi^2(1) = 7.477, p = 0.006$	$\chi^2(1) = 3.924, p = 0.048$
Overidentification test for instruments (Hansen J statistics)	$\chi^2(5) = 0.912, p = 0.969$	$\chi^2(3) = 3.366, p = 0.339$
Underidentification test for instruments (KP statistics)	$\chi^2(6) = 11.589, p = 0.072$	$\chi^2(4) = 5.951, p = 0.203$
Weak identification for instruments (CD statistics)	$F = 5.012$	$F = 2.491$
Stock-Yogo weak identification test critical value for 5% bias	19.28	16.85

Sources: Khandker and Samad 2014 using HIES and WBI surveys.
Note: Figures in parentheses are *t*-statistics. *Upazila* is the subdistrict level. For IV implementation, agricultural potential (using as proxy the share of village agricultural land irrigated, share of high land in upazila, and share of land suitable for *boro* rice production) and their interactions with household education and landholding are used as the excluded instruments for farm income in the first stage. Regression also controls for household and community characteristics; in addition, exogenous characteristics of the initial year and household occupation dummies are based on major income source. BDT = Bangladesh taka; CD = Cragg-Donald; FE = fixed effects; HH = household; HIES = Household Income and Expenditure Survey; IV = instrumental variable; KP = Kleibergen-Paap; n.a. = not applicable.
Significance level: * = 10 percent, ** = 5 percent.

informal (small-scale) manufacturing and skilled services. For formal employment, the impact is largest for samples including urban areas and rural towns relative to rural areas. The study thus provides independent, rigorous confirmation of agricultural productivity's significant impact in inducing structural transformation—within the services sector, employment in formal and skilled services grows faster than employment in low-skilled services.

Conclusions and Implications

Rural Bangladesh is growing and transforming rapidly. Agricultural growth began to accelerate steadily after the mid-1990s, when wide-ranging reforms (implemented in 1991–96) came to an end. The reforms concentrated on macroeconomic stability, growth led by the private sector, and trade and wider economic liberalization. These critical reforms added impetus to the earlier agricultural reforms of the 1980s, with the result that the trend growth rate for agriculture (over rolling 10-year periods) reached an unprecedented high of 5 percent in 2010–11. Since the 2000s, agricultural growth has also been less volatile, partly owing to chance (fewer natural disasters occurred) and partly to purposive efforts to make agriculture more resilient. In sum, the main drivers of higher and more stable agricultural growth have been the spread of irrigation, the spread of new agricultural technology, and periodic strong contributions by agriculture's three main components—crops, livestock, and fisheries.

Even under the much-improved policy framework, elements of bias against agriculture persist. Policy protection has remained for the manufacturing sector, creating an implicit bias against agriculture and distorting domestic incentives against agriculture. Some of the effects of liberalized domestic markets and a neutral, nondistortionary trade policy were swept away in the global food price crisis of 2007–08. In this sense, agriculture's strong performance over the past two decades is even more impressive, because it was achieved in the face of adverse incentives created by macropolicies—in essence, while "swimming against the tide."

The surge in growth—in agriculture and the overall economy—brought a significant reduction in poverty. The poverty headcount ratio fell from 58.4 percent in 1991–92 to 31.5 percent in 2010. The pace of poverty reduction was faster in the 2000s, with faster income growth. Bangladesh has also made progress on nonincome poverty measures, as noted in the PAR, and in food security.

The statistics in the previous passage are significant, and the gains they represent are far from superficial, but they tell only part of the story. Serious concerns remain. Rural poverty is still high at 35.2 percent in 2010, and it is deeper and more concentrated than urban poverty. Static poverty trends (estimates at discrete points of time) show a steady decline in poverty, but many households rise out of poverty only to fall back—and sometimes repeat the cycle again.

A dynamic analysis of poverty provides insights into the remaining challenges of attaining sustained poverty reduction and shared prosperity. Panel data that track the same households over a long period clearly show that pathways out of poverty are neither linear nor predictable. A large share of the households (39 percent of the sample) "churned" in and out of poverty during a period of robust growth between 2000 and 2013, indicating a high level of vulnerability. For example, while three-quarters were not poor in 2013, more than one-third of those households were highly vulnerable. The dynamic analysis emphasizes that lasting and sustained poverty reduction will require broadened policies and strategies to include the significant share of the population that is just above the poverty line.

A better understanding of the dynamics and drivers of rural poverty requires a deeper look at the transforming rural economy, especially the changing characteristics of rural households, their diverse sources of income, and the status and pattern of employment of their members. The key forces that appear to be driving growth and poverty include technology and investments in physical and human capital. Owning land, or having access to land, often determines who exits from poverty and manages to stay out. The changes in household endowments that are correlated with poverty outcomes are increases in agricultural capital per agricultural worker and improvements in households' human capital endowment. Another notable driver is the demographic composition of households—smaller families with more workers are better able to move out of poverty. Households that fell into poverty lost natural assets (land). And while the nature of employment does not appear to be correlated with

movements out of or into poverty, an important trend is that households descending into poverty lost nonagricultural physical capital faster than they lost agricultural capital per worker.

A notable feature of the structural transformation of the rural economy, rapid in the 2000s, is that much of it appears to be taking place within the rural space itself. Rural nonfarm employment has grown at a faster pace than urban employment. But the process of change has not been uniform either temporally or spatially. There is a steady, though not dramatic, transformation in the aggregate structure of economic activities. Within the post-2000 period, the early years saw the nonfarm sector grow faster than the farm sector, but the latter years saw a shift in the relative contribution, with the farm sector growing more rapidly.

An analysis of the dynamics of household incomes and poverty status at different points in time highlights the importance and varying contributions of different sources of income (farm, nonfarm, and remittances) to household welfare. Upwardly mobile households rely on multiple income strategies as mutually reinforcing pathways out of poverty. Similarly, households that managed to stay out of poverty employed multiple income strategies to maintain their economic status. Agriculture was a major source of growth for most of the dynamic poverty groups. Yet when households descended into poverty, nonfarm income declined the most, highlighting the risks associated with nonfarm sources of income, particularly trade and business activities. Finally, remittances are an important driver of incomes and poverty reduction for those who had the opportunity to benefit, but many of the poor have not been able to participate.

Not surprisingly, an increasing share of rural households, up from 80 percent in 2000 to 87 percent in 2010, relied on agriculture for at least part of their income, while 65 percent have incomes from both farm and nonfarm sources. Most rural households thus retain one "leg" in agriculture as central to their strategy to climb out of poverty. The share of households receiving remittances has remained steady at about 23 percent, as has the share of remittances in average household income (rising from 8 percent to 10 percent between 2000 and 2010).

The primary conclusion of this analysis is that both the farm and nonfarm sectors must be targeted for sustaining the progress in growth and poverty reduction. There is strong evidence on the reinforcing and interdependent nature of the individual parts of the rural economy. Agriculture's contribution to growth is both direct and indirect—its direct share in GDP has declined (to about 20 percent), but every 10 percent of agricultural growth catalyzes another 6 percent of nonfarm growth, indicating that strong forward and backward linkages are at work. Given land as a binding constraint, Bangladesh's current socioeconomic conditions, and the higher marginal returns to nonfarm activities, it is imperative to achieve growth in rural nonfarm incomes.

Against this background, the following chapters look at the dynamics of the farm and nonfarm sectors of the rural economy. They seek to understand the major features of each sector, assess the main drivers and constraints to its growth, and identify where attention must be focused to promote faster and

more sustainable growth. As noted, this study treats remittances as distinct from other nonfarm sources of income. Migration is a rapidly growing phenomenon in Bangladesh, and remittances are an important source of household income. Proactive promotion of migration requires actions that differ from actions needed to stimulate drivers of the local economy, and as such they have different implications for policy. A deeper analysis of the drivers and determinants of migration requires more detailed analysis that is beyond the scope of this study and remains an important area for future research.

Annex 2A: Detailed Results of the Analysis of Rural Dynamics

Table 2A.1 Marginal Effects from Probit Estimates, Movers versus Chronically Poor Households

	2000–04		*2004–08*		*2000–08*	
	Marginal effects	*Standard errors*	*Marginal effects*	*Standard errors*	*Marginal effects*	*Standard errors*
Sex (female = 1)	0.087	(0.131)	–0.064	(0.102)	0.120	(0.123)
Age group of HH head (ref.: below 30)						
31–45 years	–0.010	(0.050)	0.064	(0.054)	0.044	(0.048)
46–60 years	0.001	(0.059)	0.133**	(0.061)	0.090	(0.059)
60+ years	–0.051	(0.077)	0.053	(0.070)	0.110	(0.077)
HH size	–0.035***	(0.010)	–0.040***	(0.011)	–0.010	(0.010)
Total workers in HHs	0.081**	(0.033)	0.129***	(0.029)	0.082**	(0.033)
Log (own land in base year)	0.017***	(0.006)	0.011	(0.008)	0.018***	(0.006)
Tenant HHs in base year (yes = 1)	–0.026	(0.038)	–0.067*	(0.039)	–0.022	(0.039)
Average schooling year per worker in base year	0.005	(0.005)	0.015***	(0.005)	0.009*	(0.005)
Migration status in base year						
Domestic migration	0.029	(0.048)	0.060	(0.046)	0.139***	(0.049)
Foreign migration	0.315***	(0.116)	0.377***	(0.106)	0.201	(0.126)
Female participation (yes = 1)	–0.103	(0.099)	0.001	(0.081)	–0.125	(0.101)
Occupation of workers (ref.: nonfarm only)						
Farm only	–0.079*	(0.046)	–0.052	(0.050)	–0.071	(0.045)
Both	–0.024	(0.073)	–0.103	(0.065)	–0.167**	(0.071)
Log (agricultural capital per agricultural worker in base year)	0.003	(0.004)	0.001	(0.004)	0.002	(0.004)
Log (nonagricultural capital per nonagricultural worker in base year)	0.013***	(0.002)	–0.001	(0.003)	0.003	(0.002)
NGO loan in base year (yes = 1)	0.046	(0.040)	0.027	(0.042)	0.020	(0.041)
Bank loan in base year (yes = 1)	–0.098	(0.078)	0.180**	(0.075)	0.087	(0.079)
Noninstitutional loan in base year (yes = 1)	–0.064	(0.049)	–0.085	(0.055)	–0.007	(0.049)

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Table 2A.1 Marginal Effects from Probit Estimates, Movers versus Chronically Poor Households *(continued)*

	2000–04		*2004–08*		*2000–08*	
	Marginal effects	*Standard errors*	*Marginal effects*	*Standard errors*	*Marginal effects*	*Standard errors*
Infrastructure						
Distance from nearest market	–0.031	(0.034)	–0.034	(0.033)	–0.046	(0.034)
Distance from the capital	–0.156**	(0.070)	–0.008	(0.065)	–0.166**	(0.070)
Urbanization rate in 2000	0.006**	(0.003)	—	—	0.005	(0.003)
Density in 2000	–0.000	(0.000)	—	—	–0.000	(0.000)
East-West dummy (West = 1)	0.112	(0.071)	0.093	(0.075)	0.164**	(0.070)
Agroecological zone control	Yes		Yes		Yes	
Observations	795		719		795	
Pseudo R^2	0.08		0.13		0.11	

Source: World Bank calculations using MH panel survey data.
Note: HH = household; NGO = nongovernmental organization. — = not available.
Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2A.2 Marginal Effects from Probit Estimates, Faller Compared to Never Poor Households

	2000–04		*2004–08*		*2000–08*	
	Marginal effects	*Standard errors*	*Marginal effects*	*Standard errors*	*Marginal effects*	*Standard errors*
Sex (female = 1)	0.054	(0.117)	0.034	(0.084)	–0.020	(0.100)
Age group of HH head (ref.: below 30)						
31–45 years	–0.009	(0.048)	–0.087*	(0.048)	–0.094*	(0.049)
46–60 years	–0.085*	(0.050)	–0.14***	(0.050)	–0.120**	(0.050)
60+ years	0.001	(0.070)	–0.109*	(0.057)	–0.090	(0.068)
HH size	0.013	(0.009)	0.012	(0.008)	0.014	(0.009)
Total workers in HHs	0.029	(0.024)	–0.010	(0.020)	–0.040*	(0.024)
Log (own land in base year)	–0.02***	(0.007)	–0.022**	(0.009)	–0.013**	(0.006)
Tenant HHs in base year (yes = 1)	0.014	(0.035)	–0.038	(0.030)	0.038	(0.033)
Av. schooling year per worker in base year	–0.02***	(0.004)	–0.02***	(0.004)	–0.02***	(0.004)
Migration status in base year						
Domestic migration	0.020	(0.042)	–0.11***	(0.034)	0.012	(0.040)
Foreign migration	–0.084	(0.055)	–0.18***	(0.046)	–0.039	(0.050)
Female participation (yes = 1)	–0.011	(0.089)	–0.067	(0.062)	–0.025	(0.082)
Occupation of workers (ref.: nonfarm only)						
Farm only	0.115***	(0.045)	0.055	(0.038)	0.021	(0.040)
Both	–0.012	(0.052)	–0.009	(0.042)	0.058	(0.056)
Log (agricultural capital per agricultural worker in base year)	–0.001	(0.004)	0.000	(0.003)	–0.007*	(0.004)
Log (nonagricultural capital per nonagricultural worker in base year)	–0.01***	(0.002)	–0.003	(0.002)	–0.004*	(0.002)
NGO loan in base year (yes = 1)	0.004	(0.041)	0.028	(0.031)	0.094**	(0.037)
Bank loan in base year (yes = 1)	–0.016	(0.052)	–0.14***	(0.051)	0.009	(0.048)
Noninstitutional loan in base year (yes = 1)	0.021	(0.055)	0.019	(0.053)	–0.005	(0.056)

table continues next page

Table 2A.2 Marginal Effects from Probit Estimates, Faller Compared to Never Poor Households *(continued)*

	2000–04		*2004–08*		*2000–08*	
	Marginal effects	*Standard errors*	*Marginal effects*	*Standard errors*	*Marginal effects*	*Standard errors*
Infrastructure						
Distance from nearest market	–0.026	(0.030)	0.008	(0.025)	–0.001	(0.029)
Distance from the capital	0.105**	(0.051)	0.109***	(0.041)	0.129***	(0.049)
Urbanization rate in 2000	0.003	(0.002)	—	—	–0.001	(0.002)
Density in 2000	–0.000	(0.000)	—	—	0.000	(0.000)
Health shock between the period (yes = 1)	0.039	(0.031)	–0.027	(0.029)	–0.015	(0.118)
East-West dummy (West = 1)	–0.147**	(0.066)	–0.119**	(0.056)	–0.121*	(0.063)
Agroecological zone control	Yes		Yes		Yes	
Observations	766		879		766	
Pseudo R^2	0.09		0.14		0.10	

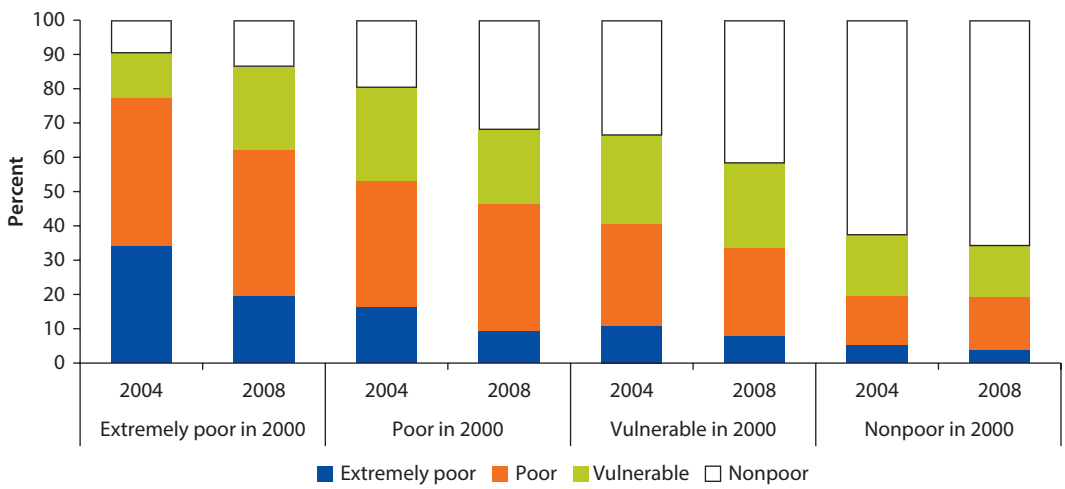
Source: World Bank calculations using MH panel survey data.
Note: HH = household; NGO = nongovernmental organization. — = not available.
Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2A.3 Poverty and Vulnerability among Panel Households, 2000–08

	2000		*2004*		*2008*	
Poverty profile	*Frequency*	*Percent*	*Frequency*	*Percent*	*Frequency*	*Percent*
Extremely poor	279	17.44	242	15.13	148	9.25
Poor	537	33.56	477	29.81	472	29.50
Vulnerable	306	19.13	345	21.56	327	20.44
Nonpoor	478	29.88	536	33.50	653	40.81
Total	*1,600*	*100.00*	*1,600*	*100.00*	*1,600*	*100.00*

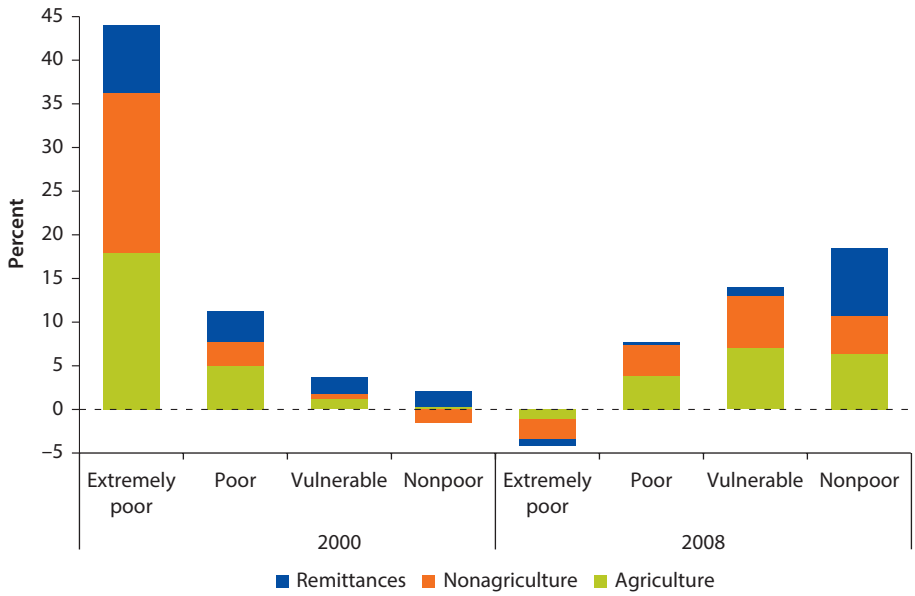
Source: World Bank calculations using MH panel surveys.

Figure 2A.1 Dynamics of the Poverty Status of Household, 2000–2004–2008



Source: World Bank calculations using MH panel surveys.

Figure 2A.2 Sectoral Contributions to Income Growth for Different Income Groups, 2000–08



Source: World Bank calculations using MH panel surveys.

Table 2A.4 Dynamic Earnings Function: Regression Results

Dependent variable: change in log per capita income	*Full sample*		*Extremely poor*		*Poor*		*Vulnerable*		*Nonpoor*	
Lag of log real income	–0.78***	(0.02)	–0.95***	(0.05)	–0.89***	(0.04)	–0.92***	(0.07)	–0.68***	(0.05)
Female → male	0.17	(0.14)	–0.06	(0.26)	0.30	(0.32)	0.17	(0.26)	0.22	(0.28)
Male → female	0.07	(0.12)	–0.12	(0.24)	0.23	(0.22)	–0.10	(0.24)	–0.04	(0.19)
Male → male	0.27***	(0.10)	0.08	(0.25)	0.48**	(0.22)	0.12	(0.22)	0.11	(0.16)
Change in log age	0.10*	(0.05)	0.10	(0.14)	0.11	(0.09)	0.12	(0.11)	0.18*	(0.11)
Lag of log age	0.12***	(0.05)	0.21*	(0.12)	0.16*	(0.09)	0.09	(0.10)	0.12	(0.09)
Change in log land	0.05***	(0.01)	0.04***	(0.01)	0.03***	(0.01)	0.07***	(0.02)	0.09***	(0.02)
Lag of log land	0.05***	(0.01)	0.03**	(0.02)	0.03***	(0.01)	0.10***	(0.02)	0.07***	(0.02)
Change in log HH size	–0.68***	(0.06)	–0.81***	(0.12)	–0.60***	(0.08)	–0.54***	(0.14)	–0.82***	(0.08)
Lag of log HH size	–0.50***	(0.04)	–0.62***	(0.11)	–0.53***	(0.06)	–0.53***	(0.09)	–0.44***	(0.08)
Change in log worker's education	0.02***	(0.00)	0.02**	(0.01)	0.03***	(0.01)	0.01	(0.01)	0.02***	(0.01)
Lag of log worker's education	0.02***	(0.00)	0.01	(0.01)	0.03***	(0.01)	0.02**	(0.01)	0.02**	(0.01)

table continues next page

Table 2A.4 Dynamic Earnings Function: Regression Results *(continued)*

Dependent variable: change in log per capita income	*Full sample*		*Extremely poor*		*Poor*		*Vulnerable*		*Nonpoor*	
Change in log agricultural capital	0.02***	(0.00)	0.02**	(0.01)	0.03***	(0.01)	0.01	(0.01)	0.03***	(0.01)
Lag of log agricultural capital	0.03***	(0.00)	0.03***	(0.01)	0.03***	(0.01)	0.01	(0.01)	0.03***	(0.01)
Change in log nonagricultural capital	0.05***	(0.00)	0.05***	(0.01)	0.05***	(0.01)	0.05***	(0.01)	0.05***	(0.01)
Lag of log nonagricultural capital	0.05***	(0.00)	0.06***	(0.01)	0.05***	(0.01)	0.05***	(0.01)	0.05***	(0.01)
Institutional loan										
No → yes	–0.00	(0.03)	–0.15*	(0.08)	0.01	(0.05)	0.00	(0.07)	0.10*	(0.05)
Yes → no	0.04	(0.03)	–0.05	(0.09)	0.06	(0.06)	0.11	(0.08)	0.01	(0.06)
Yes → yes	0.01	(0.03)	–0.01	(0.08)	0.06	(0.05)	0.01	(0.06)	0.02	(0.05)
Noninstitutional loan										
No → yes	–0.02	(0.04)	0.05	(0.07)	–0.01	(0.07)	–0.14	(0.08)	–0.01	(0.07)
Yes → no	–0.01	(0.04)	0.05	(0.08)	0.01	(0.07)	–0.05	(0.12)	0.02	(0.09)
Yes → yes	–0.04	(0.08)	0.04	(0.12)	0.08	(0.13)	–0.35**	(0.14)	–0.15	(0.28)
Occupational mobility										
Farm → both	0.21***	(0.05)	0.37***	(0.10)	0.17*	(0.10)	0.18*	(0.11)	0.16	(0.11)
Farm → nonfarm	0.20***	(0.05)	0.28**	(0.13)	0.11	(0.07)	0.05	(0.11)	0.34***	(0.09)
Both → farm	–0.06	(0.05)	–0.04	(0.12)	0.02	(0.09)	–0.16	(0.16)	–0.16*	(0.10)
Both → both	0.12**	(0.05)	0.08	(0.15)	0.23***	(0.08)	0.18*	(0.11)	–0.01	(0.09)
Both → nonfarm	0.14**	(0.06)	0.33**	(0.16)	0.28***	(0.11)	0.22	(0.16)	0.01	(0.10)
Nonfarm → farm	–0.10**	(0.05)	–0.07	(0.12)	–0.04	(0.08)	0.05	(0.10)	–0.24**	(0.10)
Nonfarm → both	0.11*	(0.06)	–0.09	(0.19)	0.09	(0.09)	0.27**	(0.12)	0.13	(0.10)
Nonfarm → nonfarm	0.20***	(0.03)	0.31***	(0.10)	0.25***	(0.06)	0.30***	(0.07)	0.18***	(0.07)
Female participation										
Nonpartic. → partic.	0.09	(0.06)	0.07	(0.13)	–0.03	(0.13)	0.20	(0.15)	0.14	(0.10)
Partic. → nonpartic.	0.11*	(0.07)	0.24**	(0.12)	0.06	(0.11)	–0.05	(0.20)	–0.02	(0.11)
Partic. → partic.	0.14**	(0.07)	–0.20	(0.21)	0.33**	(0.16)	0.16	(0.16)	0.01	(0.10)
Change in migration status										
Nonmigration → domestic migration	–0.01	(0.04)	–0.02	(0.10)	0.02	(0.07)	–0.06	(0.11)	0.10	(0.07)

table continues next page

Table 2A.4 Dynamic Earnings Function: Regression Results *(continued)*

Dependent variable: change in log per capita income	*Full sample*		*Extremely poor*		*Poor*		*Vulnerable*		*Nonpoor*	
Nonmigration → foreign migration	0.76***	(0.07)	0.85***	(0.16)	1.06***	(0.15)	0.59***	(0.14)	0.69***	(0.12)
Domestic migration → domestic migration	0.04	(0.05)	–0.00	(0.12)	0.12	(0.09)	–0.14	(0.10)	0.12	(0.08)
Foreign migration → foreign migration	0.90***	(0.06)	1.62***	(0.40)	0.91***	(0.15)	0.83***	(0.21)	0.82***	(0.08)
Head's base year's education										
Primary	0.03	(0.03)	–0.12*	(0.06)	0.06	(0.04)	–0.04	(0.06)	0.14**	(0.06)
Secondary incomplete	0.06*	(0.03)	–0.05	(0.09)	0.08	(0.06)	–0.09	(0.07)	0.15**	(0.06)
Secondary complete	0.24***	(0.04)	–0.20	(0.13)	0.15*	(0.08)	0.11	(0.08)	0.31***	(0.07)
2008	–0.03	(0.02)	0.00	(0.06)	–0.06	(0.04)	0.01	(0.04)	0.07*	(0.04)
Division										
Chittagong	–0.42***	(0.10)	–0.22	(0.22)	–0.48***	(0.14)	–0.60***	(0.21)	–0.38	(0.24)
Sylhet	–0.40***	(0.11)	–0.50**	(0.21)	–0.43*	(0.22)	–1.24***	(0.22)	–0.30	(0.19)
Dhaka	–0.03	(0.06)	–0.23	(0.16)	–0.04	(0.09)	–0.32**	(0.14)	0.13	(0.11)
Khulna	–0.02	(0.07)	–0.48**	(0.21)	–0.03	(0.16)	–0.28*	(0.15)	0.14	(0.13)
Rajshahi	0.12	(0.12)	0.10	(0.27)	0.19	(0.19)	–0.40*	(0.24)	0.25	(0.29)
Constant	7.16***	(0.31)	8.70***	(0.74)	7.86***	(0.59)	9.32***	(0.73)	5.94***	(0.69)
Agroecological zone control	Yes		Yes		Yes		Yes		Yes	
Observations	3,118		528		1,060		594		936	
Adjusted R^2	0.497		0.575		0.430		0.447		0.491	

Source: World Bank calculations using MH panel survey data.
Note: Standard errors in parentheses. HH = household.
Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Notes

1. The Zivot-Andrews unit root test for structural break allows for the break point to be determined endogenously from the time-series data on agricultural GDP. The data used are from 1976 to 2014, leaving out the turbulent years of the early 1970s.
2. Agricultural GDP is defined to include crops and horticulture, livestock, forestry, and fisheries; the sector's share is taken as the share of real GDP at producer prices using the national accounts data from the Bangladesh Bureau of Statistics (BBS).
3. The share of employment in agriculture is interpolated for the years between the various Labour Force Surveys (LFSs), which were carried out in 1991, 1996, 2000, 2003, 2005, and 2010.

4. According to previous LFSs, agricultural employment rose from 48.9 percent in 1995–96 to 51.3 percent in 1999–2000 and 51.7 percent in 2002–03 before starting the decline documented in later surveys.
5. Farm incomes experienced faster growth per capita (at 1.2 percent per year between 2005 and 2010) than nonfarm incomes, including remittances (at 1.0 percent per year between 2005 and 2010). Between 2000 and 2005, farm incomes per capita grew at 0.99 percent per year while nonfarm incomes (again, broadly defined to include remittances) grew relatively faster at 1.02 percent per year.
6. Here and for most of the analysis in this report, remittances are considered as distinct from other nonfarm sources of income. Remittances are a rapidly growing nonfarm source of income. They are not derived from the local economy; as such, they require actions that differ from actions needed to stimulate local drivers of economic activity and so have different implications for policy.
7. Estimates from HIES need to be interpreted carefully, as they show that in 2010 only 13.72 percent of rural households (12.28 percent of all households) had migrant members (4.84 percent reporting domestic migrants and 9.25 percent reporting foreign migrants). When only households with migrant members are considered, only about 7 percent of household income, on average, comes from remittances, a figure that has remained constant since early 2000. It is likely, however, that some households do not currently have dependents or nuclear family members who are migrants but nevertheless receive remittances, perhaps from extended family or adult offspring who are no longer considered to be part of the current family as defined in the survey framework.
8. This information was not collected in the census of 2013.
9. A moderately calorie-deficient individual is defined as consuming fewer than 2,122 kilocalories per day. A severely calorie-deficient individual is defined as consuming fewer than 1,805 kilocalories per day.
10. These terms are first used in Sen (2003) and, more precisely, in Deininger, Narayan, and Sen (2009).
11. Sen, Ahmed, and Gautam (2015) performed an analysis of poverty dynamics over a longer period (between 1988 and 2008). They identified similar trends and drew similar conclusions.
12. Risers are households that saw a one-way movement out of poverty; they transitioned from being poor in 2000 to being nonpoor in 2013. This transition could have occurred between any of the three intervening periods (2000–04, 2004–08, or 2008–13). Similarly, fallers are households that initially were not poor but saw a one-way movement to poverty in 2013. Churners are households that moved into and out of poverty multiple times—for example, households that were not poor in 2013 but experienced at least one episode of poverty prior to 2013, and those that were poor in 2013 but experienced at least one episode of not being poor prior to 2013. Included in the nonpoor churners are households that were poor in all three previous surveys but were not poor in 2013 (11.2 percent), because these households are deemed to be highly susceptible to falling back into poverty. Similarly, poor churners in 2013 include households who were nonpoor in each of the three previous rounds but were poor in 2013 (3.4 percent); this group is also considered to be vulnerable rather than to be definitive fallers.
13. Any specific poverty line is essentially arbitrary, and a household's position above or below a specific cutoff depends significantly on the household's "luck of the draw" at

any point in time, but the larger issue here is not that vulnerability and poverty are relative but that a large number of households are nevertheless exposed to the risk of impoverishment.

14. The longer-term analysis from 1988 is in Sen, Ahmed, and Gautam (2015).
15. The change in per capita real income is regressed on a range of factors (base-year values and the change between the previous and current survey at the household level), such as demographic characteristics, human capital, physical and financial assets, and market access, while controlling for division and year fixed effects.
16. These estimates are based on growth rates from 1974 to 2014. As expected, the hypothesis of nonstationarity is rejected for all three growth rates—GDP, agriculture, and nonagriculture. Including a time trend to control for temporal divergence, the elasticity of GDP to agricultural growth rates remains at a substantial 0.4, suggesting a robust long-term relationship. Using an alternative specification to test the relationship between nonagricultural and agricultural growth gives an elasticity of 0.26.
17. To address potential endogeneity and establish the direction of change from farm to nonfarm income, Khandker and Samad (2014) use exogenous agroclimatic endowments to instrument farm income growth, which is expected to affect nonfarm income only indirectly through the induced effects on farm income (using a fixed effects instrumental variables model, controlling for a set of household and community characteristics that may influence both farm and nonfarm income growth, including initial characteristics). Statistical tests confirm that agricultural income growth can be a good predictor of nonfarm income growth.
18. Economic censuses of 2000, 2006, and 2009; population censuses of 1990, 2000, and 2010; HIES 2000, 2005, and 2010; and rainfall data from the Climate Research Unit of the University of East Anglia.

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CHAPTER 3

Agricultural Growth and Its Drivers

Introduction

Bangladesh overcame dire expectations of widespread starvation in the early 1970s to attain its goal of self-sufficiency in rice, its main staple.[1] Table 3.1 provides a snapshot of agriculture's massive and laudable achievements since that time. Some of those challenges persist—the very limited land base with virtually no room to bring more land under cultivation; one of the highest population densities in the world; extreme vulnerability to natural disasters (also among the highest in the world); an undiversified production base; and poor infrastructure, including roads, power, and irrigation.

The improved performance of agriculture owes a significant debt to proactive economic and social policies. Significant demographic changes—specifically falling family sizes and rising human capital—and technological changes have contributed to the impressive growth in output per capita. The reduction in family size and entry of large numbers of better-educated young people into the workforce are delivering a demographic dividend in overall productivity to Bangladesh.

As discussed in chapter 2, agriculture (directly or indirectly) remains a major driver of Bangladesh's increasingly complex rural economy, with its widening array of interrelated sectors. Agriculture's relative size in the economy, shown earlier in chapter 1, figure 1A.1, is becoming smaller, which is typical for a transforming economy, but this trend does not indicate that agriculture is becoming irrelevant. In a transforming economy, agriculture's role changes from being a direct or primary contributor to economic output to making a more leveraged contribution through powerful farm-nonfarm linkages that have long been recognized in development economics.

As structural transformation proceeds, an increasingly nonagricultural population will heighten the demand on the resources (human and land) remaining in the sector to be more productive. Agriculture will be called upon to sustainably meet the growing demand for basic foods; accommodate the changing dietary

Table 3.1 Bangladesh Has Transformed Agriculture Since the Early 1970s

Early 1970s (1972–73)	*Early 2010s (2012–13)*
Total food grain production: 10 million t	Total food grain production: 34 million t–35 million t
Average rice yield: 1 t/ha	Average rice yield: 3 t/ha
Less than 7% of net cultivated area is irrigated	More than 80% of net cultivated area is irrigated
Fertilizer use at 45 kg/ha (net sown area basis)	Fertilizer use at 530 kg/ha (net sown area basis)
Rainfed aus and aman = 78% of rice output	Irrigated boro = 57% of rice output
Total population: 71 million	Total population: 157 million
Food grain availability per capita: 410 g per day	Food grain availability per capita: 616–32 g per day

Source: Updated from Hossain and Bayes 2009.
Note: *Aus* is rice sown in March–April and harvested in the summer; *aman* is rice sown or transplanted in spring or summer and harvested in November–December; *boro* is rice grown in the October–March dry season. g = grams; ha = hectare; kg = kilograms; t = tons (metric).

patterns arising from rising incomes and urbanization; and meet the growing imperatives for more diverse, safer, and more nutritious foods.

For agriculture to fulfill this expanding role, Bangladesh must ensure that the transformation of its economy is accompanied by a smooth transition to a more productive, climate-resilient, and diversified agriculture. Progress has been slower than expected. Structural shifts within agriculture have been limited, and they remain the biggest challenge facing the sector. The main tasks of this chapter are to analyze drivers of past growth and identify priority actions going forward.

Evolving Structure of Agriculture

The direct contribution of agriculture to the overall economy and the changing role of agriculture are reflected in the sector's performance and composition. Table 3.2 summarizes how the size of the sector has evolved; table 3.3 shows how growth rates of the various agricultural subsectors have evolved.

The strength of agriculture's contribution to the rural economy has varied over time. The sector's growth in recent years—over 5 percent per year in 2009–10 and in 2010–11—and its contribution to reducing rural poverty are well established. Nevertheless, this impressive performance continues to be peppered with periodic shocks, as in 2012–13, when the overall growth rate plummeted because of unfavorable weather. In addition, the moderation in real prices since 2010 has led to a slowing of growth in the crops subsector to less than 2 percent. The periodic shocks underscore the continuing vulnerability of Bangladeshi agriculture to climate shocks, even though it is less than in the past.[2]

The broad subsectoral composition of agricultural gross domestic product (GDP) has changed to a limited extent. Crops, particularly rice, still dominate the sector, currently contributing about 58 percent of sectoral GDP, a relatively small decline from 64 percent in the early 1980s (see annex 3A, figure 3A.1). Growth is relatively less stable in crops than in the other subsectors, livestock, fisheries, and forestry, which have grown more consistently over time. All subsectors—as well as the overall economy—experienced a slowdown in the early 2000s, but outside that brief period, forestry and fisheries have recorded

Table 3.2 Subsectoral Shares of GDP and Composition of Agricultural Value Added, FY80–FY11
percent

	FY80	*FY89*	*FY99*	*FY09*	*FY11*
Share in GDP					
Crops	21.1	18.0	14.0	11.4	10.9
Livestock	4.2	3.6	2.9	2.6	2.5
Forestry	2.2	2.0	1.8	1.7	1.7
Fisheries	4.7	4.2	5.9	4.5	4.4
Total	*32.2*	*28.6*	*24.6*	*20.2*	*19.4*
Share in agricultural GDP					
Crops	65.6	65.5	57.1	56.3	58.8
Livestock	13.0	12.6	11.8	13.1	12.9
Forestry	6.8	7.1	7.3	8.5	8.8
Fisheries	14.6	14.8	23.8	22.1	22.7
Total	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*

Source: BBS.

Table 3.3 Agriculture and Population Growth Rates, 1990–2014
percent

	1990–2014	*1990–99*	*2000–09*	*2000–04*	*2005–09*	*2010–14*
Agriculture, of which:	3.7	2.3	4.2	2.7	5.0	3.2
Crops and horticulture	3.4	0.9	4.0	2.5	5.0	1.8
Animal farming	2.1	2.2	2.0	2.0	2.2	2.7
Forestry	4.5	3.3	5.0	4.9	5.3	5.3
Fishing	5.7	7.0	5.8	2.5	6.8	5.9
GDP	5.2	4.5	5.6	4.5	6.1	6.1
Population	1.6	2.1	1.3	1.5	1.1	1.2

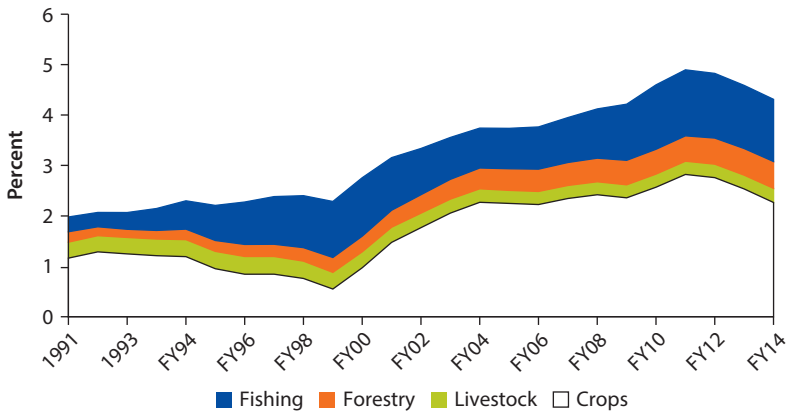
Sources: National accounts GDP data in constant FY 2005 prices from BBS; and population growth rate from WDI (World Bank).
Note: Growth rates are trend growth rates for the specific periods.

consistently high growth rates, with fisheries emerging as an increasingly important driver of growth across the agricultural sector. Figures 3.1 and 3.2 illustrate these points.

Crops Subsector

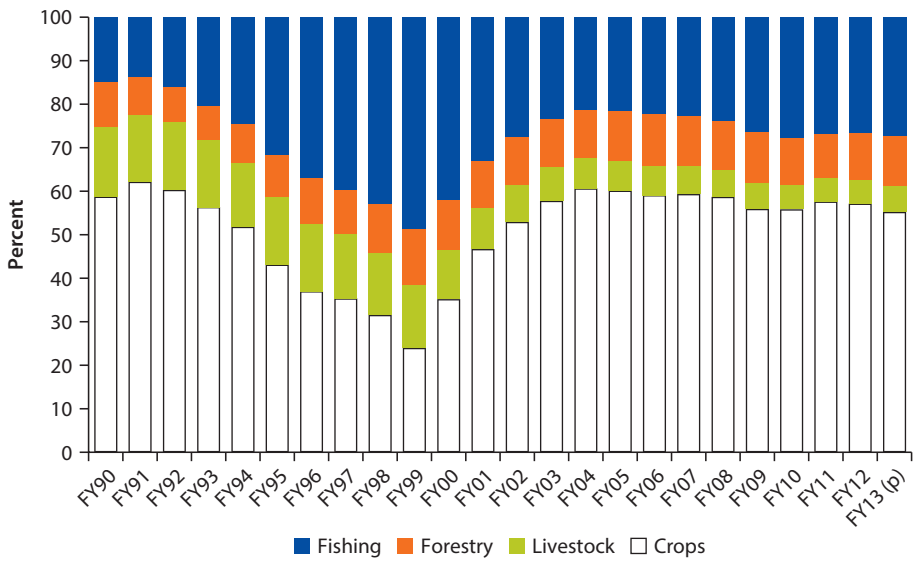
Within the crops subsector, the broad structure of production appears to have changed little. Diversification (figure 3.3), calculated using the area-based Simpson Diversity Index,[3] is low, reflecting the substantial 77 percent to 80 percent of cultivated land devoted to paddy between 1991 and 2012. The share of area under paddy increased in the 2000s, contrary to what may be expected or desirable; on average the area allocated to rice between 2000 and 2010 was higher than in the 1990s. It has reduced since then, and by 2012 it fell to the 1990 level. These trends partly reflect the introduction of newer and better rice varieties: new technology appears to have reversed diversification out of rice.

Figure 3.1 Subsectoral Agricultural Growth



Source: World Bank calculations using BBS data.

Figure 3.2 Subsector Shares in Agricultural GDP Growth

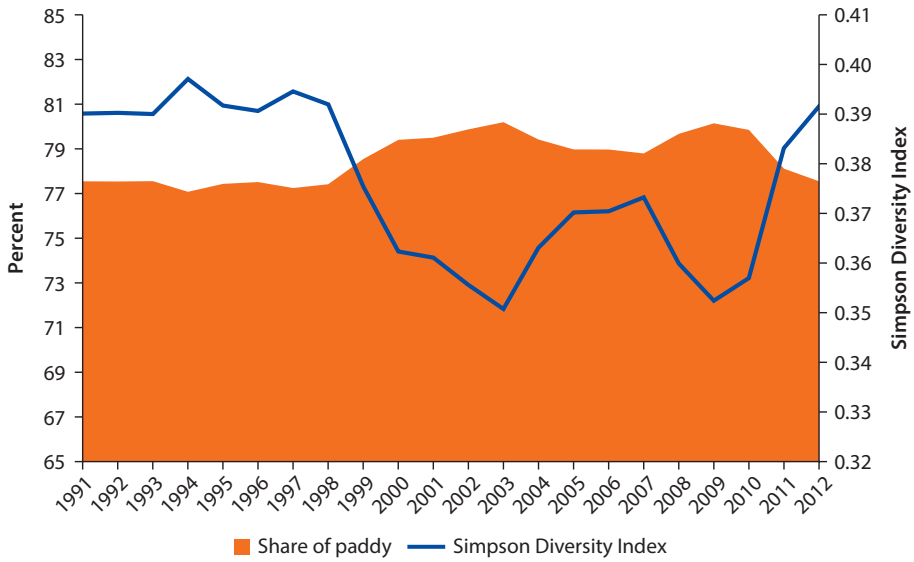


Source: World Bank calculations using BBS data.
Note: p = projected.

In more recent years, improved incentives have driven the trends in a more complex fashion. Higher rice prices have induced an increasing emphasis on rice, and the rising prices of high-value crops have caused the remaining area to be reallocated to them. In value terms, the share of rice has registered a decline from 74 percent to 66 percent of the value of output for crops (see annex 3A, figure 3A.2). These trends are consistent with evidence from the micro level.

The level of diversification is analyzed at a more disaggregated level (by division) using the two data sources that allow reliable calculation—the Agricultural

Figure 3.3 Trends in Crop Diversification, 1991–2012



Source: World Bank calculations using FAOSTAT.

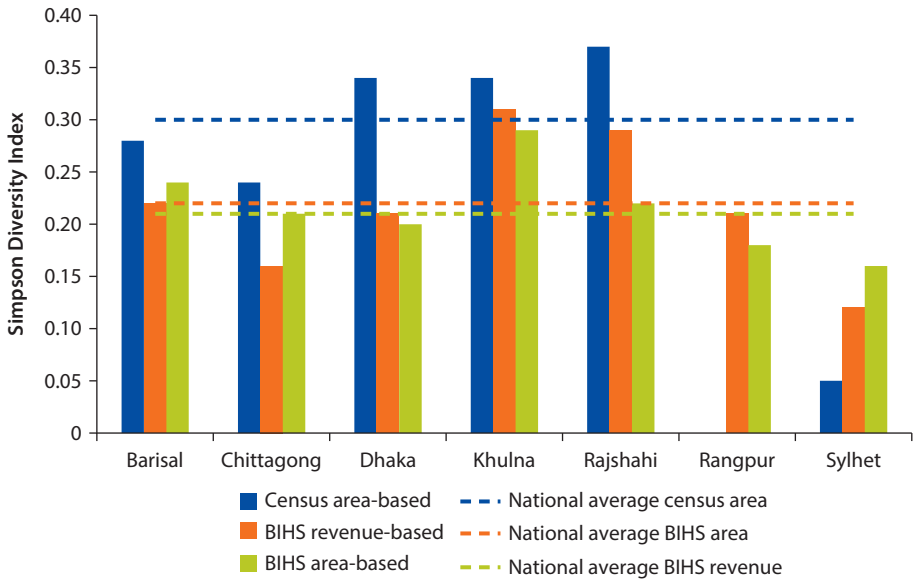
Census of 2008 and the nationwide Bangladesh Integrated Household Survey (BIHS) (IFPRI 2013) of 2011–12. The Agricultural Census allows only area-based diversification to be estimated, since it does not have price data (for the six original divisions).[4] The BIHS allows estimations of area and revenue diversification indices for the seven divisions (figure 3.4) in Bangladesh. Estimates from the two sources differ somewhat, but in both cases, the micro-level household surveys show a lower level of diversification than in national aggregates.[5]

Overall, the revenue and area diversification indices show heterogeneity across divisions. Diversification in the eastern divisions (Chittagong, Dhaka, and Sylhet) is lower than in the western divisions (Barisal, Khulna, and Rajshahi), showing consistent patterns for area- and value-based indices.

For crops other than rice, important changes are taking place, reflecting evolving demand patterns and preferences (figure 3.5). An important shift is the decline in wheat and other cereals, oilseeds, and pulses, which are being replaced by maize, fruits and vegetables, roots and tubers, and jute. Over the long term, wheat area and production have moved up and down, but pulses and oilseeds have steadily declined, superseded by strong growth in vegetables, potatoes, and spices since the 1980s (annex 3A, table 3A.1).

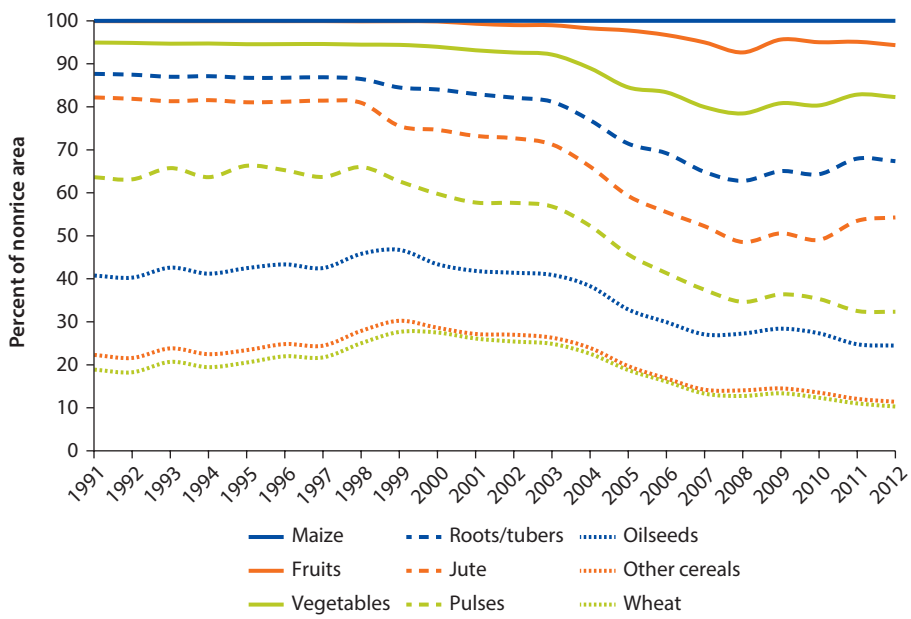
Rice remains the largest contributor to growth in the crops subsector, but its contribution is proportionately less than its share in the value of output (table 3.4). Recent strong performers include root crops, jute, maize, and to some extent wheat and vegetables. (Among the root crops, potato area got a particularly strong boost, maintained with the opening in 1998 of the Jamuna Bridge, which connects the western districts to Dhaka and Chittagong and

Figure 3.4 Diversification by Division



Sources: World Bank calculations using BBS 2008 and BIHS 2011–12 (IFPRI 2013).

Figure 3.5 Area Planted to Crops Other than Rice, 1991–2012



Source: World Bank calculations using FAOSTAT.

Table 3.4 Shares of Crop Groups in Growth of the Crops Subsector and Value of Output

		Average share of output and growth 2006–12 (%)	
Crop group	*Growth (%)*	*Output*	*Growth*
Paddy	3.7	65.9	57.2
Roots/tubers	8.3	10.2	20.1
Jute/fibers	9.4	2.8	6.3
Spices	4.0	5.4	5.1
Maize	9.1	1.6	3.5
Wheat	5.5	2.2	2.8
Vegetables	4.7	2.3	2.5
Fruits	1.5	5.5	2.0
Oil crops	5.1	1.1	1.3
Soybean	2.0	0.2	0.1
Other cereals	–12.3	0.0	0.0
Cash crops	–0.1	2.1	–0.1
Pulses	–6.6	0.6	–0.9

Source: World Bank calculations using BBS data.

Table 3.5 Maize Production, Area, and Yield, 1981–2012

	Annual average				*Growth rate (%)*			
	1981–90	*1991–2000*	*2001–05*	*2006–12*	*1981–90*	*1991–2000*	*2001–05*	*2006–12*
Production (t)	2	3	307	1,104	15.01	0.79	46.10	—
Area (thousand ha)	3	3	55	179	6.19	–1.04	26.64	—
Yield (t/ha)	0.76	1.05	5.66	6.17	8.30	1.85	15.36	—

Source: BBS.
Note: ha = hectares; t = tons (metric); — = not available.

facilitates their access to national and global economic opportunities.) Rapid growth in disposable income has spurred demand for the highly income-elastic horticultural crops, helping horticultural crops (especially vegetables) record impressive growth records. Growth has been variable, however; the major problem faced by producers of horticultural crops is production and price volatility. Jute is experiencing something of a renaissance owing to growing global demand for natural fibers. Maize is another crop that stands out for its growth performance (table 3.5), following the rapid emergence of the poultry industry and the private sector's introduction of new varieties (hybrids).

Noncrop Agriculture: Livestock and Fisheries

The livestock and fisheries subsectors are strategically important for Bangladesh because they buffer volatility in the sector's overall growth, augment food and nutritional security, contribute to poverty reduction, and generate jobs. Poultry and dairy farming have specific advantages over crops, fisheries, and forestry

because these operations require less land and are not significantly affected by seasonality. Fisheries are an important traditional source of protein in the Bangladeshi diet, and the subsector makes an important contribution to export growth.

The fisheries subsector has performed consistently better than livestock, as reflected in the estimates of GDP by subsector (shown in table 3.2). Since the early 1990s, except for the years between 2000 and 2004, fisheries experienced higher and more consistent growth than livestock.

The official data provide a somewhat contradictory picture of the livestock subsector's contribution, however. The subsector has made a continuous but low contribution to overall GDP growth, and the share of animal farming declined steadily from about 15 percent of agricultural GDP in the early 1980s to about 11 percent over 2009–13 (see annex 3A, figure 3A.1). Yet other official sources of data on physical production trends for three key livestock products (milk, meat, and eggs) show a different, more positive picture than the GDP estimates for the subsector (table 3.6).[6] Growth rates for milk, meat, and egg production improved in the 1990s but have become much more volatile since 2000. In 2000–05, meat production grew by more than 14 percent annually, milk production by nearly 7 percent, and egg production by 12 percent. In 2005–10, growth in production slowed sharply for all three products but then rebounded to grow at phenomenally high rates: 29 percent for meat, 26 percent for milk, and 16 percent for eggs. These growth rates suggest that producers have responded strongly to the growing demand for these income-elastic foods (with rapid GDP growth and the implied increase in incomes in recent years).

While these livestock products have shown robust growth, the growth in livestock numbers has been modest. Over the past five years (to 2014), poultry numbers grew at 3 percent, followed by goats and sheep at 2.8 percent (Finance Division 2014). Cattle numbers, on the other hand, have grown at the very low rate of about 0.4 percent over the same period.

Numbers of all three major types of livestock—cattle and buffaloes, sheep and goats, and poultry—declined on medium farms (from 2.5 acres to less than 7.5 acres) and large farms between 1996 and 2008 (Ali and Hossain 2014). In contrast, on marginal and small farms (less than 2.5 acres), livestock numbers increased over the same period, displaying impressive growth (36.0 percent for cattle and buffaloes, 28.4 percent for goats and sheep, and 14.4 percent for

Table 3.6 Trends in Milk, Meat, and Egg Production, 1991–2014

							Annual average growth (%)				
Item	*1991*	*1995*	*2000*	*2005*	*2010*	*2014*	*1991–95*	*1995–2000*	*2000–05*	*2005–10*	*2011–14*
Milk (million t)	1.34	1.41	1.6	2.14	2.37	6.09	1.31	2.69	6.75	2.15	25.60
Meat (million t)	0.45	0.51	0.62	1.06	1.26	4.52	3.33	4.31	14.19	3.77	29.10
Eggs (million)	2,040	2,530	3,500	5,623	5,742	10,168	6.00	7.67	12.13	0.42	15.90

Sources: Finance Division 2014; Shahabuddin 2014.
Note: t = tons (metric).

poultry). Small and marginal farms continued to dominate the production of all three types of livestock.

The relatively slower growth in stock numbers and faster growth in animal products indicate faster growth in yields. Technology has been quite an important driver of growth in livestock production (similar to its role in crop production), especially through crossbreeding of cattle and of goats and disease control in poultry.

The livestock subsector's varied and uneven growth over time is worrisome in relation to the rapidly rising demand for livestock products. According to the Department of Livestock Services (DLS), Ministry of Fisheries and Livestock (see www.dls.gov.bd), current production of milk, meat, and eggs is able to meet only about 43 percent, 67 percent, and 64 percent, respectively, of existing demand for these products. If the recent trends continue, future shortfalls are expected to be significantly larger.[7]

The fisheries subsector consists mainly of (a) inland open water capture fisheries, (b) inland closed water culture fisheries, and (c) marine fisheries.[8] In 2013–14, total estimated fish production was 3.5 million tons, allocated as shown in table 3.7.

The overall fisheries subsector has grown more rapidly than the livestock subsector but has also shown some inconsistency, notably declining in 2001–05 but then resuming its longer-term rapid rate of expansion. One possible reason for this growth fluctuation is that a good share of fisheries—inland freshwater capture fisheries—depends on the vagaries of nature, particularly the monsoon. Another may be demand: domestic demand and exports have grown rapidly since 2000 but can fluctuate due to a range of exogenous factors. Another reason, advanced by Shahabuddin (2014), is that the slowdown of 2001–05 was a natural phase of consolidation following the rapid increase of pond fisheries in the earlier period.

Inland fisheries have undergone a structural transformation since 2000. Before then, most fish came from inland freshwater capture fisheries, but now culture fisheries account for 52 percent of fish output versus 42 percent from capture fisheries. The catch from ponds, ditches, and coastal shrimp farms almost doubled between 2001 and 2011. The main source of growth in inland capture fisheries is the floodlands, whereas the major source of growth in culture fisheries is ponds and ditches. A comparison of Household Income and Expenditure

Table 3.7 Total Fish Production, 2013–14

Type of fishery	*Production (t)*	*% of total*
Inland open water capture	995,805	28.1
Inland closed water culture	1,956,925	55.1
Marine	595,385	16.8
Total	*3,548,115*	*100.0*

Source: Department of Fisheries 2014.
Note: t = tons (metric).

Survey (HIES) data for 2005 and 2010 also shows consistent shifts in consumption patterns across all income groups, with total fish consumption rising but consumption of wild fish declining. It is generally believed, however, that the fish catch (and consequently per capita fish consumption) is underreported, particularly for culture fisheries.

With marine fisheries, primary harvesting increased between 2001–02 and 2012–13, rising from 415,420 tons to 588,988 tons, although as a share of total annual fish production it has remained at 18 percent, coming mostly from small-scale coastal artisanal fishers.

While overall fish production has increased over time, and opportunities exist to improve the contribution of fisheries to economic growth, significant challenges remain. For inland freshwater capture fisheries, a key challenge is to continue reforms in the arrangements for leasing water bodies, with a focus on sustainable management and economic returns. Leases for *jalmahals* (closed water bodies) of less than 8.1 hectares are now negotiated with registered fisher organizations, which can reduce the risk of leases being appropriated by local elites; however, the leasing period remains limited to between one and three years (Toufique and Ahmed 2014). This time frame is too short to provide sufficient incentives for long-term sustainable fisheries management. Alternative approaches to leasing can provide secure use rights without the government giving up land and water ownership. One option put forward by various experts is a long-term lease (perhaps up to 50 years) at nominal fixed rates per hectare, subject to renewal and extension at 10-year intervals based on satisfactory management and conservation performance by the leaseholder against an approved management plan. Performance could be monitored by *upazila* (subdistrict) fisheries committees. Thus communities that continue to meet performance standards will retain long-term, secure use rights. Other priorities include the need to improve productivity of these water bodies and to support better market access for community-based producer groups and organizations (Milne, Jansen, and Fernando 2009). Destruction of immature fish (ova, larvae, breeding fish) and use of illegal fishing gear are additional internal barriers to growth. Broader issues affecting the productivity of inland water bodies include land degradation (causing siltation), pollution of water bodies from urban and industrial areas, and climate change (Toufique and Ahmed 2014).

For inland culture fisheries, key challenges include improving the arrangements for communities to lease government-owned ponds. Although the leases are issued for a fixed period (in some cases up to 25 years), there are no provisions for renewal, and this uncertainty can reduce incentives for long-term, sustainable management. For private lands, the issue of multiple owners often arises when ponds extend across multiple properties. Other challenges include poor technical management and low productivity, high costs, poor quality of hatchery fry, and market access, including traceability and food safety systems (Miah 2015).

Both inland culture and capture fisheries help reduce poverty, aid in food production, and provide protein to the rural poor. The WorldFish Center (2006)

has estimated that another 1 million hectares of inland waters could potentially be developed for productive fishing in floodlands (70 percent of additional area), rivers and estuaries (10–15 percent of additional area), and inland closed waters (10–15 percent of additional area). Bringing this estimated incremental area under well-managed fish production could raise gross revenues from fishing by US$2 billion; generate an additional 1.5 million full-time equivalent jobs, mostly with the rural poor; and create significant upstream and downstream indirect jobs and enterprises.

While some of the external barriers to growth, such as pollution, cannot be easily addressed, substantial scope for improvement exists. The Department of Fisheries has maintained a long association with local and international development partners in piloting new approaches for inland fisheries. As an example, for freshwater capture fisheries in large *beels*, advanced models involving a joint stock company or public limited company with local fishers holding shares along with landowners have shown great potential to improve production, quality, and incomes. In addition, the government and donors have invested time and resources to develop and pilot community-based fisheries management regimes to better manage capture fisheries. The lessons from these models point to the possibility of crafting relatively more efficient institutions capable of addressing appropriation problems (rent maximization, reducing conflicts, and so on) and issues from the open access that currently characterizes the open water fisheries (for example, by helping community groups develop and maintain breeding sanctuaries, using appropriate fishing gear, and enforcing a closed season) (Toufique and Ahmed 2014).

For inland culture fishing, integrated aquaculture and livestock models have shown significant improvements in productivity. Promoting community-based management has also helped to improve productivity for government ponds.

Brackish shrimp production along the coast contributes greatly to exports of fish products. Key challenges are to improve product quality and quality assurance arrangements, support producer groups and marketing systems, and mitigate environmental impacts. Opportunities to address these issues include scaling up contract grower schemes that link small producers with large processing companies, expanding training for producers in quality assurance and application of the international Hazard Analysis and Critical Control Points (HACCP) system, and training producers in improved environmental management.

For marine fishing, a key challenge is to address issues of overcapacity relative to sustainability and economic performance. A recent study (Moman and Arnason 2007) estimated that the *hilsa* fisheries were generating almost zero annual net economic returns, but with long-term reforms around fishing rights and capacity reductions, the potential annual net economic returns could be as high as US$260 million. As part of a long-term reform process, policy makers might develop basic management activities including (a) updated stock assessments for key species such as hilsa; (b) an effective vessel registration system; (c) use of bioeconomic models to identify current and future resource rents for key stocks; (d) implementation of improved education and awareness programs;

and (e) piloting community-based fishing for inshore fishers based on stronger resource rights and well-defined management plans for key fish stocks. For a pro-poor policy, the priority of resource access should be shifted to poor, shore-based artisanal fishers, then to small-scale offshore fishers, then finally to larger commercial trawlers. Some existing steps address these issues, but much more work remains to be done.

Farm Growth by Ecology

Another way to assess drivers of agricultural growth is by agroecological zone (AEZ). An AEZ is an area characterized by homogeneous agricultural and ecological characteristics. Agroecology has an increasingly important role in agricultural planning, technology transfer, and the use of specific biophysical resources, and Bangladesh has delineated 30 AEZs based on four elements: physiography, soil properties (important for plant growth, moisture supply, root aeration, and nutrient supply), land levels in relation to flooding, and agro-climate (which also influences cropping patterns and potential) (annex 3A, table 3A.4).[9]

To facilitate the analysis of agricultural growth, potential, and constraints, the 30 AEZs can be grouped into a more manageable set of 8 clusters based on broadly similar characteristics, as shown in table 3.8. Crop agriculture has experienced the most growth in three land clusters (the plains, beel lands, and Barind land), where high-yielding *boro* rice varieties for the October–March growing season have led a major boost in crop production. In these clusters, the availability of water (through irrigation using ground and surface water) played a significant role, as did technology and access to markets.

Irrigation as a driver of production growth depends on topography (land level). Bangladesh has four types of land level: highland (above the normal flood level),

Table 3.8 Composition of Clustered Agroecological Zones and Current/Future Crop Options

Agroecological zone (AEZ) cluster	*AEZs forming the cluster*	*Current and future crop options*
Plain land	1, 3, 4, 6, 8, 9, 11, 12, 16, 17, 19, 20, 22, and 30	Aman, HYV boro, jute, sugarcane, wheat, maize, potatoes
Char land	2, 7, and 10	Aus, deep-water aman, jute, rabi pulses
Coastal	13, 17, 18, 19, 23, and 24	Aus, HYV boro, wheat, chili, vegetables
Beel	5, 14, and 15	HYV boro, aus, jute, sugarcane, pulses
Sylhet basin	21	Rabi vegetables, mustard
Barind land tract	25, 26, and 27	Broadcast aman, HYV aus, potatoes, wheat
Madhupur	28	Groundnuts, deep-water aman, mustard
Hills	29	Tea, pulses, cotton

Source: Faruqee 2012.
Note: AEZs are listed and defined in table 3A.4 in annex 3A. *Aman* is rice sown or transplanted in spring or summer and harvested in November–December; *aus* is rice sown in March–April and harvested in the summer; *boro* is rice grown in the dry season between October and March; *rabi* is the dry season (November–May). *Beel* land has small (seasonal or permanent) bodies of water; *char* land is newly formed coastal land. HYV = high-yielding variety.

medium high land (normally flooded to a depth of up to 90 centimeters during the flood season), medium low land (normally flooded 90–180 cm), lowland (normally flooded 180–300 cm), very low land (normally flooded deeper than 300 cm). Bottomland remains wet throughout the year. The depth range for each flooding class is not rigid, however—flood levels in an area may vary by a meter or more in different years, and they may also peak for only a few days at a time during a particular year.

The cropping pattern in each land class depends on the level of flooding anticipated by farmers when they decide which crops to grow in the *kharif* season (April–November, overlapping with the monsoon) on the different land types present on their farms. Farmers' long experience of cultivation on particular sites guides their choice of crops.

An examination of cropping patterns and cropping intensity by irrigation type and status adds another dimension to the discussion of how agroecology affects crop selection and potential. For example, where the main sources of water for crops are rainfall and surface water irrigation, the cropping pattern is paddy cultivation followed by fallow (or paddy followed by a nonpaddy crop), but in areas where groundwater is mostly used for irrigation, two consecutive paddy crops is the main pattern. Groundwater irrigation is used on 15–20 percent of the land in areas where rainfall or surface water irrigation forms the default water regime. Groundwater irrigation has the advantage of providing a regular supply of water for cropping, but the water supply is irregular where surface water and rainfall dominate.

Crop diversification is more common, to varying degrees, on high and medium land. It is least common on low land, because early flooding negatively affects vegetables, fruits, and other high-value crops. These patterns are borne out by the longitudinal MH panel surveys, which show how technical efficiency in farming (discussed later) and crop diversity vary by ecological area (see table 3.9).

To assess the impact of ecology on cropping pattern, cultivated land can also be broadly categorized into two main segments—favorable and unfavorable zones. In favorable zones, water is fairly reliably available; no salinity, fear of drought, or excessive flooding are present. In unfavorable zones, natural conditions (mainly soil and water stress) tend to be the main determinant of cropping patterns. Despite the disadvantages of growing rice in unfavorable zones, such as lower yields and lower returns relative to other crops, the lack of alternatives and

Table 3.9 Farm Efficiency and Crop Diversity by Broad Agroecological Zone, 2000–08

	Farm efficiency (%)			*Crop diversity index*		
Zone	*2000*	*2004*	*2008*	*2000*	*2004*	*2008*
Flood-prone	0.737	0.773	0.695	0.232	0.191	0.164
Drought-prone	0.715	0.699	0.754	0.243	0.186	0.228
Saline coast	0.702	0.778	0.752	0.187	0.215	0.265
Nonsaline coast	0.763	0.762	0.672	0.039	0.0472	0.0517

Source: Ahmed and Gautam 2015.

Table 3.10 Production Patterns by Broad Agroecological Zone, 2008

Zone	*Rice area share (%)*	*VOP ratio*	*Paddy yield (t/ha)*
Flood-prone	78	1.1	4.2
Drought-prone	76	2.4	3.5
Saline coast	77	1.4	3.0
Nonsaline coast	96	0.6	3.1
Favorable	82	1.0	3.9

Source: World Bank calculations using MH panel surveys.
Note: VOP ratio is the ratio of value of production per hectare of nonrice crops to rice, reflecting the noncrop premium over rice. ha = hectares; t = ton (metric).

the need to secure the food supply compel cropping patterns to relay on rice. For example, in 2008 paddy yields were lowest in coastal areas (table 3.10). Except for the nonsaline coast, where the value of output per hectare is higher for rice than for other crops (and households accordingly devote almost all of their cropped area to rice), in all other areas households still invest heavily in paddy. For crops other than rice, some degree of specialization is seen in the drought-prone areas (in jute) and along the saline coast (in pulses and potatoes), whereas crop choice is more diversified in other areas. The concentration in rice, even where agroclimatic conditions are not ideal, suggests a significant opportunity cost in terms of foregone income.

Policy Reforms and Their Impacts

In broad aggregate terms, the key driver of agricultural growth has been increased productivity made possible through policy reform. Key reforms since the 1980s have facilitated irrigation through the rapid spread of groundwater pumps, improved technology through the use of high-yielding plant varieties and fertilizer, better connectivity and linkages to packaging, processing, and markets for farm products (and more efficient markets) through investment in roads, and changes in land market operations through mechanization (Shahabuddin 2014). The roles and contributions of the drivers have varied over time and by area, but the aggregate trends are clear.

Policy reform has been an important driver of agricultural growth both at the macro level and at the sectoral level. Sectoral reforms were initiated in the 1980s when the government made major reforms in agricultural input markets, starting with fertilizer markets. The first stage of reforms liberalized the retail trade in fertilizer, and the second stage liberalized the wholesale market, with progressively greater participation of private traders. The bold steps taken by the government, and the speed with which they were implemented, were supported by donors through financing to import fertilizer and to train farmers to use it alongside new high-yielding varieties.

In tandem, the government took steps to liberalize markets for other inputs, including irrigation and water management, and seeds. The irrigation system,

which began with large public irrigation projects, gradually moved to private enterprises. First, low-lift pumps were used by private farmers or groups of farmers to draw water from the myriad rivers crisscrossing Bangladesh. Second, privately owned, small-scale tubewells gradually developed for extracting groundwater. Until 1980, BADC[10] (a public institution) procured and distributed small-scale irrigation equipment, such as pumps and shallow tubewells; in 1980, BADC-owned irrigation equipment was privatized. In 1988 the government eliminated restrictions on imports of agricultural equipment, and farmers started investing their own resources to set up shallow tubewells. Informal markets for irrigation water developed quickly with the rapid expansion in privately owned shallow tubewells. In highly land-constrained Bangladesh, the rapid expansion of irrigation increased the productivity of land (yield per hectare) and also facilitated greater intensification (using more inputs per hectare) as well as improved efficiency (using inputs more effectively).

Recognizing the importance of a strong seed sector for technological change, the 1993 National Seed Policy sought to strengthen the seed system (Naher and Spielman 2014). The National Seed Policy changed the seed system from a public sector orientation to involve the public and private sectors as well as civil society organizations. The Seeds (Amendment) Act 1997 and the Seed Rules 1998 further liberalized the regulations for seed certification and allowed the marketing of truthfully labeled seed.

These reforms of seed, fertilizer, and irrigation markets are widely credited for bringing about substantial gains in agricultural production, especially of rice, but few studies have empirically measured the impact of market reforms. Ahmed (1995) estimated the direct impact of liberalized input markets, distinguishing between the pre- and post-liberalization periods, and concluded that reforms in fertilizer and irrigation markets could reasonably be credited with the success in rice production in the post-liberalization period (between 1984 and 1992). Specifically, approximately 20–32 percent of the increase in production could be attributed to the impact of the reforms on fertilizer consumption and private irrigation development. In a further study, Ahmed (1999) also concluded that food grain shortages and higher food prices would have persisted without changes in the fiscally unsustainable public intervention in agricultural input markets in Bangladesh.

Important reforms have also been introduced in output markets, and specifically with respect to procurement and trade of food grains. In line with the broader liberalization efforts of the early 1990s, Bangladesh deregulated imports of rice and scaled back public procurement and distribution to allow the private sector to function more freely. The efficacy of these decisions, and the efficiency of Bangladeshi entrepreneurs in responding to the changed policy environment, is evident from the fact that until 2007, when India imposed an export ban on rice, rice prices in Bangladesh remained low and stable. The prices were found to very closely follow the subsidized (Below Poverty Line) public distribution price of India (Dorosh and Rashid 2013), clearly demonstrating smoothly functioning markets. This experience since

1994 demonstrates the important role the private sector has played—even through the massive and devastating flood of 1998—in delivering a period of highly stable domestic prices up to 2007.

Reforms did not continue unabated. Policies in support of market liberalization were partially reversed in the late 1990s, and following the 2007 food crisis, input subsidies and public intervention in grain markets through domestic and international procurement of rice and wheat increased substantially. In 2005, restrictions were introduced in the seed sector prohibiting private sector breeding for notified crops (with the exception of rice), while rules and regulations on the registration and release of varieties were maintained. The adverse effects of those reversals (and remaining policy impediments) were mitigated to some extent by growth in productivity and, more recently, by rising prices for agricultural products. In other words, the reforms unleashed a surge in growth, with sustained—even through periodic reversals—increases in productivity of factors of production.

The new National Fisheries Policy, approved in 1998, included detailed policies for conservation, management, and exploitation of fisheries resources; quality control; planning; monitoring and evaluation; fisheries extension; and human resources development. A comprehensive National Fisheries Strategy and Action Plan was developed in 2006 to guide implementation of the strategy within the overall policy framework. The strategy focused on core areas, including long-term planning; people's participation; coordination, collaboration, and support for the sector; the regulatory framework; pro-poor approaches; gender; alternative sources of income generation for fishers; and environmental management. The more recent (2008) National Strategy for Accelerated Poverty Reduction reinforces the government's commitment to implement the fisheries strategy and accelerate growth of the fisheries subsector, especially through the intensification of inland aquaculture, a stronger focus on export-oriented species, ensuring sustainable biodiversity and preserving natural breeding grounds for inland fish, improving product diversification and value addition, and developing appropriate market infrastructure. While these policy and strategy papers provide a strong foundation and a clear road map for future fisheries development, their implementation to date has been fairly limited.

Going forward, it is important to address the remaining policy distortions to create a balanced incentive structure across crops and to promote noncrop subsectors. Those distortions are a critical constraint on the next surge in growth, which will have to be driven by diversification. In the broad policy framework, analysis consistently highlights the need to level the policy field that currently bestows significant advantages to rice (through output price support, procurement, and price stabilization); reorient public expenditures toward high-return technology services and infrastructure; and address the remaining regulatory barriers to more effective private sector participation in the seed sector.

Sources of Agricultural Growth

The analysis of the sources of agricultural growth uses two approaches that offer different and complementary insights into the growth process and the implications for public policy. One approach—restricted to the crops subsector, because data are not available to extend the analysis to the other subsectors—entails decomposing the change in the value of aggregate output into its five main contributing factors: changes in area, prices, yields, and diversification, plus an interaction term that captures the unexplained residual change arising from various interactions among the other four factors. The restriction to crops has limitations for explaining broader growth throughout the sector, but it is still relevant and insightful, because crops dominate agricultural output and contribute the largest share of sectoral growth.

The second approach is a total factor productivity (TFP) analysis, which explains growth in output in relation to the relative contributions of inputs and the improvement in their productivity. If this analysis were restricted to the crops subsector, in effect it would build upon the analysis based on revenue decomposition by looking at the factors driving yields, and specifically at the roles of technology and policy in driving the more effective use of inputs to raise yields. In this instance, however, a broader TFP analysis can be done by using an aggregate output index that incorporates crop and livestock outputs (though not fisheries).

Decomposition of Crop Revenue Growth

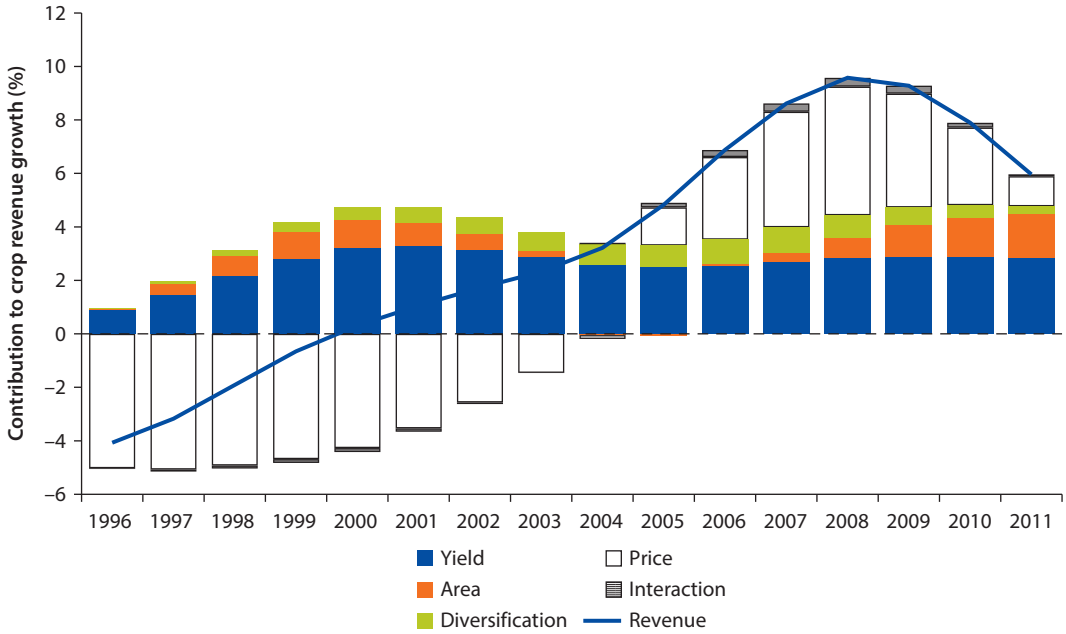
Growth in aggregate crop revenues could arise from increases in area, yield, or prices (real) or from switching from low-value, low-productivity crops to high-value, high-productivity crops. Using the methodology described by Minot et al. (2006), crop revenues are decomposed into these four components, and an interaction term is used to capture the residual that cannot be explained by the four individual components but arises through various interactions among them.

The analysis uses data for 1996–2011 from the Food and Agriculture Organization (FAO), the only source of consistent annual time-series data on prices, area, and production by crop for Bangladesh. The analysis is done at the national level, again due to data limitations; an attempt was made to compile a district database, but the data were incomplete, covered a very limited time period, and were outdated. For the analysis, the time series for area, production, and prices are smoothed to remove the large annual fluctuations and better identify the underlying trends.

Figure 3.6 presents year-on-year changes in crop revenue growth for each of the components, providing an idea of the changes over the 15-year period. The figure shows that growth in the value of crop output behaved in a cyclical manner, falling during the 1990s and recovering around 2000, increasing to 2008, and then declining somewhat since then. These trends are consistent with the trends in GDP for the crops subsector shown in chapter 2, figure 2.1.

The dominant driver has been prices. Prices fell in the 1990s and constrained revenue growth until 2004, when they rose sharply, contributing significantly to

Figure 3.6 Decomposition of Aggregate Crop Revenue Growth, 1996–2011



Sources: FAOSTAT, World Bank.

growth during 2007 and 2008, the years of the food price crisis. Prices returned to a more moderate level by 2011, which reduced growth from those unprecedented—and unsustainable—levels. Figure 3.6 shows quite clearly that despite price fluctuations, yield (a product of technological innovation) has made a consistently high contribution to growth throughout the period after the mid-1990s—confirming the widely held view that land productivity (represented by yields) has risen significantly. How much of the increase in yields came from inputs and how much came from using those inputs more effectively—the true measure of productivity—is discussed in the section that follows.

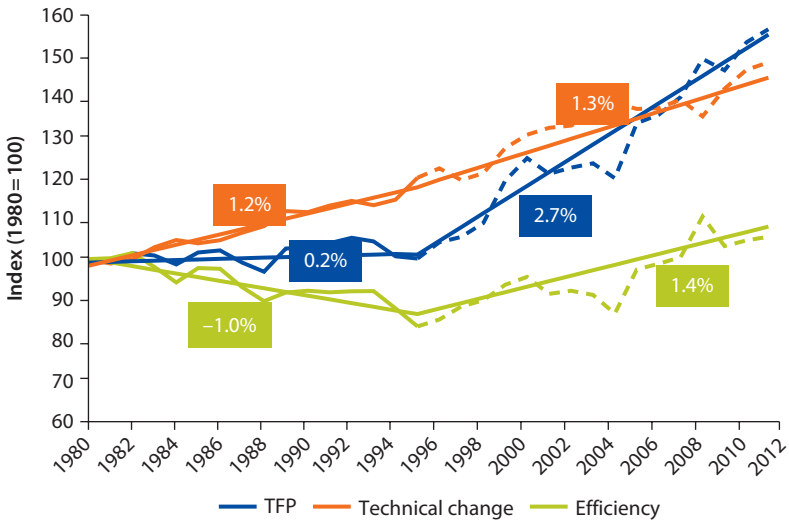
As expected, the contribution of area to growth in crop revenue has remained low, reflecting the limited availability of land. The noticeable increase in recent years has resulted mainly from the increase in irrigated area planted to boro rice.

A worrisome trend is the low and fading contribution of diversification. This trend continues to concern policy makers, because it represents an important constraint to accelerating and sustaining future growth and meeting the growing demand for a diversified food supply.

Total Factor Productivity

Estimates of TFP, which captures the relative contributions of technology and efficiency, show that at the aggregate sectoral level agricultural TFP has been rising rapidly since the mid-1990s. Applying a hybrid methodological model (growth accounting combined with nonparametric decomposition of TFP using

Figure 3.7 TFP, Efficiency, and Technical Change in Agriculture, 1980–2011



Source: World Bank calculations using estimates from Nin-Pratt 2015, using FAO data.
Note: Solid versus dashed lines highlight the before and after 1995 trends in TFP, technical change, and efficiency. TFP = total factor productivity.

the Data Envelopment Analysis or DEA) to FAO country-level data, Nin-Pratt (2015) estimates the country-specific TFP index for agriculture and decomposes TFP growth into a technical change component and an efficiency component. The derived TFP index (setting 1980 = 100) is shown in figure 3.7 (blue line), in which the trend is essentially flat until the mid-1990s and then rises sharply, indicating sustained and robust TFP growth. This break in the mid-1990s coincides almost perfectly with the structural break detected in 1996 in the agricultural GDP growth trend (discussed at the beginning of chapter 2).

Splitting the period of analysis from 1980 to 2011 into two periods (1980–95 and 1995–2011) highlights the sharp difference in growth rates for the two periods. TFP grew at an anemic 0.2 percent per year prior to 1995 but at a remarkable 2.7 percent after 1995—a trajectory sustained largely throughout the 15-year period (with the exception of the slowdown in the early 2000s).

The decomposition of TFP into two components (technical change and efficiency) shows that Bangladesh has experienced sustained growth in technical change, reflecting the impressive contribution of agricultural research and technology—the main story behind the long-term growth in rice yields. As noted, this technological impact was facilitated by important policy changes that created more responsive and flexible input and output markets. The deep impact of policy reforms is clearly visible in the striking turnaround in the trend in the efficiency component of TFP, the component most expected to be affected by policies. The declining –1.0 percent annual growth in efficiency prior to 1995 becomes a positive 1.4 percent after 1995. The change in efficiency explains the entire change in TFP between the two periods. In summary, the deep impact of

policy reforms is evident in the trend in efficiency growth, and the returns to investment in technology are evident from the strong continuous performance of technical change in driving growth.

Similar trends (table 3.11) are obtained applying the standard growth accounting methodology to the global productivity database developed by Fuglie (2012), also using FAO data. Growth in output was largely driven by inputs from 1980 to 1995, but TFP has been the main driver of growth ever since. After 1995, output growth more than doubled, while input growth slowed sharply. A depiction of the progression in the drivers of growth by decade from the 1970s to the 2000s (figure 3.8) shows that the rapid expansion in irrigation prompted most input growth in the 1980s and 1990s. By enabling farmers to plant in the dry season, irrigation has permitted the multi-cropping that has effectively expanded cultivated area. What is impressive in the figure is the steady and sustained growth in TFP since the 1990s (which figure 3.7 shows to have started in 1995), reflecting a combined impact of technology (embodied in access to better quality inputs such as seeds, helped by key regulatory reforms) and efficiency (with policy reforms creating an enabling environment for farmers to make better decisions in response to more market-based incentives).

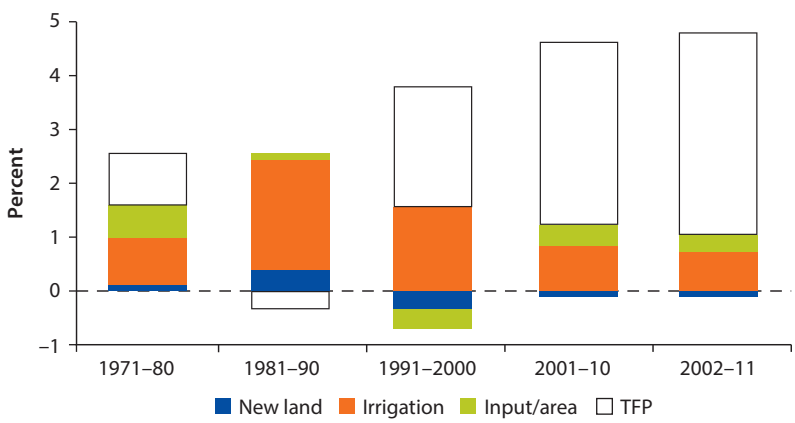
Bangladesh's performance since 1995 (TFP growth of 2.7 percent per year, according to the more conservative mixed-methodology estimate) is one of the

Table 3.11 Agricultural Total Factor Productivity Growth, 1980–2011

	1980–95	*1995–2011*	*1995–2000*	*2000–04*	*2005–11*
TFP	–0.22	2.91	4.10	–0.10	4.47
Output	1.86	4.20	4.88	1.56	5.08
Inputs	2.10	1.28	0.78	1.66	0.61

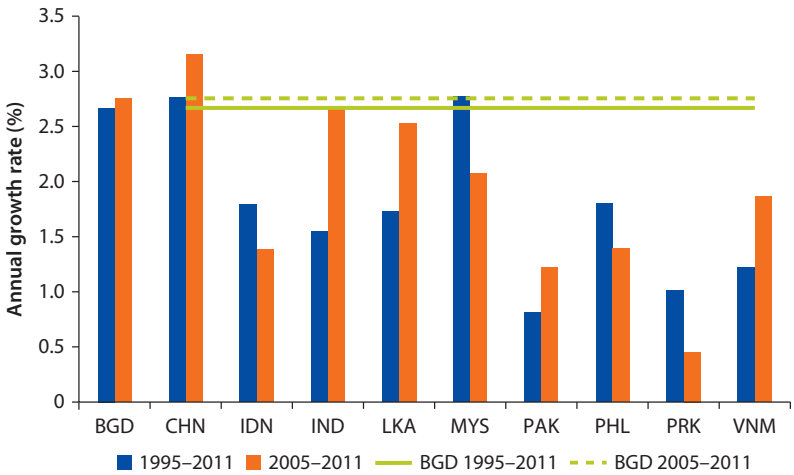
Source: Fuglie 2012.
Note: TFP = total factor productivity.

Figure 3.8 Breakdown of Productivity Growth by Decade, 1971–2011



Source: World Bank calculations using Fuglie 2012.
Note: TFP = total factor productivity.

Figure 3.9 Cross-Country Comparison of Total Factor Productivity, 1995–2011



Source: World Bank calculations using Nin-Pratt 2015.
Note: BGD = Bangladesh; CHN = China; IDN = Indonesia; IND = India; LKA = Sri Lanka; MYS = Malaysia; PAK = Pakistan; PHL = Philippines; PRK = Korea, Dem. Rep.; VNM = Vietnam.

best TFP growth rates globally over this extended period. Figure 3.9 shows the TFP performance for Bangladesh in the post-reform period compared to TFP for some major agricultural economies of South and East Asia. The estimates cover a longer period (1995–2011) and a more recent period (2005–11). Since 1995, TFP in Bangladesh grew as fast as TFP in the best performers among the comparators (China and Malaysia) and better than the others. Since 2005, China has been the only comparator with higher TFP growth; Bangladesh's performance has surpassed even the storied performance of Vietnam, an East Asian agricultural stalwart.

Even within that period of excellent performance, the going was not always smooth. The rapid growth of the late 1990s was succeeded by stagnation in the early 2000s, which did not end until after the major flood year of 2004, when TFP started growing at a historically high rate. This outcome is a result of faster output growth, reflecting the strong impact of technology and improved efficiency, and a reduction in input use that is indicative of mechanization and more effective use of inputs. Clearly Bangladeshi agriculture now (post 2004) is qualitatively different than it was in the 1980s and early 1990s.

These findings on TFP are similar to those of Rahman and Salim (2013), who look at TFP growth in Bangladeshi agriculture over six decades (1948–2008). They find that very long-term growth in TFP (over the entire 60 years) is 0.57 percent. They do not provide estimates for subperiods or the more recent performance, and hence do not analyze the likely impact of differential policy regimes. Nevertheless, their long-run estimate is similar to the TFP estimate obtained using Fuglie's database (the only other source covering a long period), which is 0.78 percent per year between 1961 and 2011 or 0.64 percent between 1961 and 2008.

The very consistent findings and conclusions from the various sources (Rahman and Salim, Nin-Pratt, and Fuglie) offer complementary insights into the dynamics of TFP. Rahman and Salim conclude that technological progress has been the main driver of TFP growth and that efficiency has stagnated over the long term—a conclusion that is consistent with the findings already discussed, with the exception that the subperiod analysis for this report highlights the critical role of policy reform in efficiency (and hence TFP). Rahman and Salim take their analysis a step further in assessing the drivers of TFP growth. They find the dominant drivers of TFP growth to be farm size, crop specialization, investment in agricultural research and development (R&D), and extension services. Education has a negative impact, suggesting that perhaps more educated individuals may be leaving agriculture for other jobs.

One drawback that remains in the analytical toolkit is that the costs of environmental and resource degradation cannot be incorporated into the estimation of TFP. Given this shortcoming, other analyses need to be considered to address these increasingly pressing concerns. An especially important issue is the declining water table in parts of Bangladesh. Alauddin and Sharma's (2013) analysis of differences between districts in the productivity of water used to produce rice finds that the overall productivity of water used to grow rice in Bangladesh is relatively low, both by South Asian and international standards, and that it varies significantly across districts. While the diffusion of technology was the key factor explaining differences in water productivity by district, Alauddin and Sharma also conclude that further technological advances are needed—specifically a renewed focus in research to develop high-yielding varieties for the kharif (wet) season, as well as varieties that tolerate salinity and drought. Improvements in water-use efficiency and water-saving technologies are other important avenues for research. Finally, an outstanding question for research—and an especially critical question for assessing the long-term sustainability of current production patterns and technology—is how to incorporate resource "costs" in the estimation of TFP.

Drivers of Technical Efficiency: Evidence from the Micro (Farm) Level

Evidence at the micro level provides important insights into the changes taking place on farms in Bangladesh. Detailed data on households' agricultural and related activities from the MH panel surveys point to a number of important issues that are highly relevant for policy and strategy (Ahmed and Gautam 2015; Gautam and Ahmed 2015). The analysis that follows focuses on the changing organization of production at the farm level, farm-level technical efficiency and its drivers, and the impact of connectivity. The implications for policy and strategy are discussed in detail at the end.

Organization of Production

As discussed elsewhere in this report, important shifts are under way in the rural economy and in how agricultural production is organized, reflecting a range of demographic, physical, and institutional developments. Table 3.12 summarizes some of the major changes occurring from 2000 to 2013.

Table 3.12 Structural Changes in Agriculture, 2000–13

	2000	*2004*	*2008*	*2013*
Labor force				
Number of earners per HH	1.56	1.63	1.58	1.51
Number of agricultural workers per HH	0.89	0.93	0.84	0.63
Number of nonagricultural workers per HH	0.67	0.69	0.73	0.88
Number of female workers per HH	0.09	0.12	0.18	0.19
Female heads of household (%)	5.89	6.94	13.53[a]	14.75
Land				
Total owned land (ha)	0.53	0.48	0.47	0.44
Total cultivated land (ha)	0.42	0.38	0.32	0.27
Per capita owned land (ha)	0.11	0.11	0.10	0.11
Per capita cultivated land (ha)	0.07	0.07	0.06	0.08
Per agricultural worker cultivated land (ha)	0.42	0.37	0.35	0.42
Proportion of irrigated land	66.3	77.4	80.3	97.1
Proportion of groundwater-irrigated land	54.6	60.9	67.0	—
Land ownership group (%)				
Absolutely landless	7.2	2.8	3.1	1.7
Functionally landless (≤ 0.2 ha)	43.0	50.8	51.1	51.1
Marginal farmer (0.2–0.4 ha)	15.2	12.7	13.5	16.0
Small farmer (0.4–1.0 ha)	19.3	20.1	19.3	19.3
Medium farmer (1.0–2.0 ha)	10.1	8.9	8.5	8.1
Large farmer (2.0+ ha)	5.2	4.7	4.4	3.7
Households renting in land	32.3	36.8	27.2	31.7
Human capital assets				
Average years of schooling of agricultural workers	3.33	3.46	3.70	3.87
Average years of schooling of nonagricultural workers	5.10	5.57	5.35	5.50
Inputs and mechanization				
Cultivator households using fertilizer (%)	96.8	96.4	97.7	—
Cultivator households with high-yielding varieties (%)	83.9	86.6	84.5	—
Cultivator households mechanized (%)	66.2	82.3	88.7	—
Households with electricity (%)	46.1	61.3	82.5	—
Agricultural capital (per agricultural worker, 2008 BDT)	8,158	8,434	11,758	—
Nonagricultural capital (per nonagricultural worker, 2008 BDT)	15,523	11,514	12,939	—
Income from activities related to agriculture (2008 BDT)				
Total agricultural income (per capita)	17,696	18,734	20,475	24,430
Rice income (per capita)	3,043	3,004	3,281	—
Nonrice crop income (per capita)	1,449	1,927	2,155	—
Noncrop agricultural income (per capita)	2,373	2,367	2,258	—
Agricultural wage income (per capita)	1,102	1,207	1,430	—

Source: World Bank calculations using MH panel surveys.
Note: BDT = Bangladesh taka; ha = hectare; HH = household; — = not available.
a. The jump in the proportion of female-headed households is consistent with the 15.3 percent estimate of female-headed rural households from HIES 2010.

The stabilization of the land/worker ratio is an important trend. Despite falling farm sizes, evident from the decreasing amounts of land owned per household as well as the shift in the pattern of land ownership toward the landless and smaller ownership categories, a simultaneous fall in family size has meant that per capita as well as per worker, cultivated land area has stabilized (though it remains very low).

An important factor behind the land-worker ratio is the share of households renting in land, mostly among the landless and functionally landless households. Almost one-third of households rent land to supplement their holdings, indicating that the land rental market is active and contributes to improved efficiency in farming by making land accessible to the more efficient farmers (as shown later). Within the rental market, tenurial arrangements have undergone important changes that are now contributing to growth. Exploitative sharecropping tenancy, which discourages agricultural investments and the adoption of new, input-intensive technologies, is giving way to fixed-rent tenancy and medium-term leasing arrangements. The area under share tenancy has declined from 91 percent of the tenanted area in 1960 to 74 percent in 1983–84, 62 percent in 1996, and 39 percent in 2008. Pressure from the market, social, and demographic forces encouraging the adoption of new technologies is thus changing Bangladesh's agrarian institutions (Hossain and Bayes 2009).

Human capital assets appear to be rising modestly, but these figures must be interpreted with caution, as the younger adults are probably splitting from the parental household of origin and starting their own families, in effect making the average household education level across household members to appear lower.

Technological progress in agriculture is clearly evident, as the vast majority of producers now use fertilizer, modern varieties, and irrigation—the key components of modern production technology. The continued strong rise in mechanization is consistent with the falling number of workers on farms. All of these trends are consistent with capital deepening in the agricultural sector (in contrast to the nonagricultural sector), where agricultural capital per agricultural worker is rising. Households' evident confidence in agriculture is undoubtedly a function of agriculture's rising profitability (as seen in the consistent increase in per capita agricultural incomes). A breakdown of the sources of farm income shows that while rice income per capita has risen over time, a bigger jump has come from nonrice crops, suggesting that those crops have grown more in value. Noncrop agricultural incomes have remained static, an unexpected outcome given the rapidly rising demand for products such as eggs, meat, and fish—but the silver lining is that the livestock and fisheries subsectors are potentially important future sources of growth.

To sum up, the key drivers of agricultural growth in Bangladesh have been the liberalization of input markets, the adoption of modern varieties, greater use of machinery, better access to markets, and the rising prices for agricultural products. The roles played by these drivers have varied in importance over time. In recent years, for example, mechanization and price hikes have had a more critical role in promoting agricultural growth than other drivers. Evidently the role of

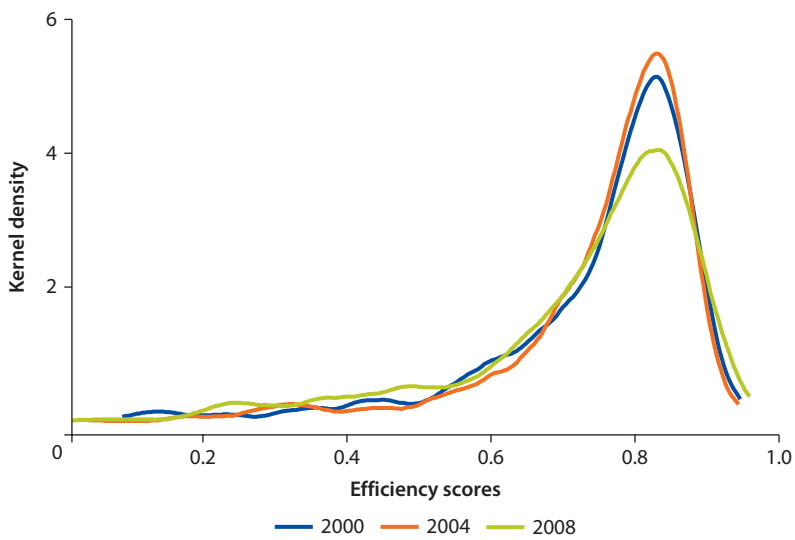
mechanization is widely appreciated; the headline article in the *Daily Star* of December 6, 2014 (Parvez 2014), proclaims that it has been the key to the production surge occurring in the last few years.

Productivity and Technical Efficiency

Stochastic frontier analysis helps to clarify how sensitive production is to different inputs and makes it possible to determine the level of relative technical efficiency for each household in the sample. The analysis also helps identify the drivers of production efficiency. At the whole-farm level, the analysis shows that the average farm operates at a reasonably high level of (relative) technical efficiency (75 percent), which has been maintained over the eight-year period for which the data are available (figure 3.10).

The median level of efficiency is estimated at a high of 79 percent, implying that more than half of the households in the sample operate at a high level of efficiency, and three-quarters operate at more than 70 percent efficiency. Some farmers (the bottom 25 percent) could improve their performance, but on the whole, differences between households appear to be low, and the potential to improve productivity also appears relatively low. Detailed data on individual crops are available only for *boro* and *aman*[11] rice, and crop-level estimates for these crops provide a similar and consistent story, with boro production being more efficient (about 82 percent) than the more risky aman paddy (70 percent). Interestingly, boro efficiency has remained steady from 2000 to 2008, whereas aman efficiency has fallen from about 76 percent to 70 percent.

Figure 3.10 Distribution of Farm-Level Technical Efficiency across Households, 2000–08



Source: Ahmed and Gautam 2015.

The regression analysis of the determinants of farming efficiency has several implications for policy. The regression results in table 3.13 show a positive and significant impact of farm size on efficiency, suggesting that the very small sizes some farms are tending toward may not be as efficient. Demographic characteristics such as age and gender of the household head are no longer such significant determinants of efficiency as they have been in the past, suggesting that controlling for other factors, experience (proxied by age) and gender of the household head are no longer a disadvantage in farming. A surprisingly consistent result across all specifications is the significant negative impact on efficiency of access to formal bank loans.

The analysis also confirms the importance of key public services. Access to electricity strongly improves farmers' technical efficiency, probably for a number of reasons, such as the greater inclination of farm households with electricity to use agricultural machinery, compared to farm households with no access to electricity. Mechanization was more prevalent (by 6 percentage points in 2008) among farmers with access to electricity than among farmers without access.

Most irrigated area is irrigated with groundwater. The regression results indicate that beyond the substantial positive impact of irrigation on productivity (in the production function estimates), the proportion of land irrigated with surface water is less efficient compared to irrigation by groundwater, suggesting a need to improve the delivery of publicly managed surface water schemes.

Two significant findings related to land are that rented land is associated significantly with higher efficiency, and land fragmentation is significantly and negatively associated with farming efficiency. Both results are intuitive to agricultural analysts and confirm long-standing conceptual arguments related to land markets. They suggest that land markets are inefficient and that better functioning land and lease markets would allow more-efficient households to rent in land (or, perhaps equally important, allow inefficient households or absentee households to rent out land without fear of losing it). In a rural economy where population is still growing at a rate higher than the natural rate of reproduction, curbing land fragmentation is challenging, but as the descriptive analysis has shown, rural households appear to be working around this problem by establishing land leasing and tenancy relationships.

Both international and domestic migration have negative signs. International migration is statistically insignificant in all cross-section estimations, while the effect of domestic migration is significant and negative in 2008. The descriptive statistics indicate that 2008 was the most successful year for farm households in terms of farm income, and the regression results for domestic migration in 2008 seem to suggest that the skills transferred out of agriculture through migration may be having a negative impact on farming efficiency. Migration may have a less negative effect on efficiency, however, if remittances generated by migration encourage farm mechanization. Farm households with foreign migrants are generally much more inclined to use agricultural machinery compared to households with no migrants. In the two earlier rounds of the survey, farm households

Table 3.13 Determinants of Technical Efficiency at the Farm Level

	(1)	(2)	(3)	(4)	(5)
Variable	*Unbalanced panel*	*Balanced panel*	*2000*	*2004*	*2008*
Log (total cultivated land)	0.025***	0.027***	0.031***	0.033***	0.010
Sex of the head (male = 1)	0.006	0.018	0.087***	0.008	–0.024
Age of head	0.000	–0.000	0.000	–0.001*	–0.000
Migration dummy					
Domestic migrant	–0.017*	–0.010	–0.006	–0.006	–0.022*
Foreign migrant	–0.019*	–0.025*	–0.015	–0.003	–0.023
Loan dummy					
Loan from bank	–0.025***	–0.029***	–0.036**	–0.029**	–0.009
Loan from NGO	0.004	0.014*	0.026*	0.010	–0.005
Loan from noninstitutional source	–0.019*	0.000	–0.057***	0.026*	–0.018
Education dummy					
Primary education	0.004	0.007	0.015	0.012	–0.015
Secondary education	0.011	0.013*	0.018	0.020*	–0.011
Secondary school certificate and above	–0.010	–0.001	–0.029	–0.012	0.007
Access to electricity (yes = 1)	0.027***	0.021***	0.016	0.040***	0.025*
Land-related variables					
Proportion of groundwater land	0.010	0.010	0.002	0.003	0.029**
Proportion of surface water land	–0.021**	–0.013	–0.030	–0.011	–0.011
Proportion of rented land	0.046***	0.051***	0.058***	–0.017	0.016
Proportion of sharecropped land	0.007	0.002	0.031**	0.014	0.010
Land fragmentation index	–0.069***	–0.072***	–0.070***	–0.071***	–0.044**
Crop diversity index	0.008	0.020	0.087**	0.033	–0.111**
Monocropped household (Yes = 1)	–0.004	–0.003	0.019	–0.008	–0.030
Connectivity					
Log (distance from market in km)	0.009*	0.005	0.010	0.026***	–0.019**
Log (distance from Thana in km)[a]	–0.024***	–0.034***	–0.046***	–0.033***	0.004
Log (distance from Dhaka in km)	–0.028***	–0.036***	–0.030***	–0.021**	–0.015
Constant	0.943***	1.023***	0.964***	0.984***	0.892***
Observations	2,712	1,876	951	1,037	872
Adjusted R^2	0.053	0.062	0.087	0.112	0.046

Source: Ahmed and Gautam 2015.
Note: Estimates for two specifications are presented in the table. Column (1) presents the results based on the unbalanced panel data, and column (2) presents results based on the balanced panel data. As is often the case, some farms do not apply specific inputs. The resulting truncated independent variable may potentially bias the production function estimates. Arbitrarily dropping these observations would also introduce a selection bias. To test for the sensitivity of estimated coefficients and the robustness of the specification to truncated independent variables, dummy variables were included in the model specification to avoid such biases. km = kilometer; NGO = nongovernmental organization.
a. Thana is where most administrative facilities and agricultural extension services are located.
Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

with domestic migrants lagged in adopting mechanization compared to households with international migrants or no migrants, but by 2008 they had surpassed the other two groups.

Impact of Connectivity on Agriculture

The substantial payoffs and potential impact from connectivity and the investments made so far in physical infrastructure in Bangladesh are apparent from the positive impact on farming efficiency of the different variables on connectivity. A major finding is that connectivity is having a much deeper impact on efficiency than improved access to and increased use of inputs. As farm size declines, improved competitiveness through more effective and efficient use of inputs, especially land and labor, is critical.

Distance from the capital city, Dhaka, reduces farming efficiency significantly. The negative impact of living in remote areas on farming efficiency has moderated over time. By 2008, the impact is not significant, which is consistent with the improvements in connectivity following increased investments in roads. Distance from Thana, where most administrative facilities and agricultural extension services are located, also matters for farming efficiency. Farm households living farther from Thana are less likely to interact with agricultural extension officers or to access other public services; they are found to be less efficient compared to households living close to the Thana headquarters. Poor access to markets also seriously limits farming efficiency, a finding that reinforces other findings on the economic importance of local connectivity.[12]

The HIES 2010 data revealed a sharp fall in poverty rates in Rajshahi and Khulna Divisions between 2005 and 2010, indicating a potential convergence of poverty rates between western and eastern Bangladesh. The Jamuna Bridge is believed to be a major catalyst of this convergence, connecting the western districts with major growth poles such as Dhaka and Chittagong and with national and global economic opportunities. A national labor market has also emerged, in which migration from the western districts has taken on an important role in reducing the welfare gap between the two regions (Sen et al. 2014).

In line with these trends, the farm efficiency analysis provides consistent results using two tests (Ahmed and Gautam 2015). A simple test of the differences between farm households in western and eastern Bangladesh shows that although no difference in efficiency was distinguished in 2000, western farmers became progressively more efficient, and a statistically significant difference in efficiency was evident by 2008. A second, more rigorous test distinguishes between farm households that are located in the western districts but relatively closer to the Jamuna Bridge than other households in the western districts. The results are clear and consistently significant. Households farther away from the bridge were significantly less efficient in 2000, but by 2008 their efficiency was not statistically different from that of households in eastern districts. Households living closer to the bridge were more efficient to begin with and have since maintained their edge.

Sustaining Productivity Growth: Challenges and Opportunities

Sustaining and furthering the impressive gains in agricultural productivity will be more challenging in the future than it was in the past. The main driver of crop productivity, boro rice production, is nearing the limits of current technological potential, land expansion is not feasible (and in fact is expected to decline with faster urbanization), and the expansion of irrigation is also at its limits. Perhaps the biggest challenge facing agriculture is the overuse, degradation, and change in quality of critical natural resources (land and water). Falling groundwater levels in parts of northern Bangladesh and increasing salinity in parts of southern Bangladesh are examples of the emerging constraints.

Climate change will add unprecedented pressures and risks. A recently completed, comprehensive analysis of the likely impacts of climate change on food security in Bangladesh (Yu et al. 2010) finds that the largest impact (due to rising temperatures, increasing rainfall variability, and rising sea level) will probably be a reduction in rice production by 3.6–4.3 percent, with the bulk of the impact on boro rice production. The study concluded that the best "no-regret" strategy to build resilience against climate change would be to focus on diversifying household incomes and increasing agricultural (crop) productivity. Closing the current large yield gaps and diversifying the production base have the potential to more than offset the predicted losses. The strategy to achieve these objectives would prioritize investments in R&D, education, skills development, and water and land management.

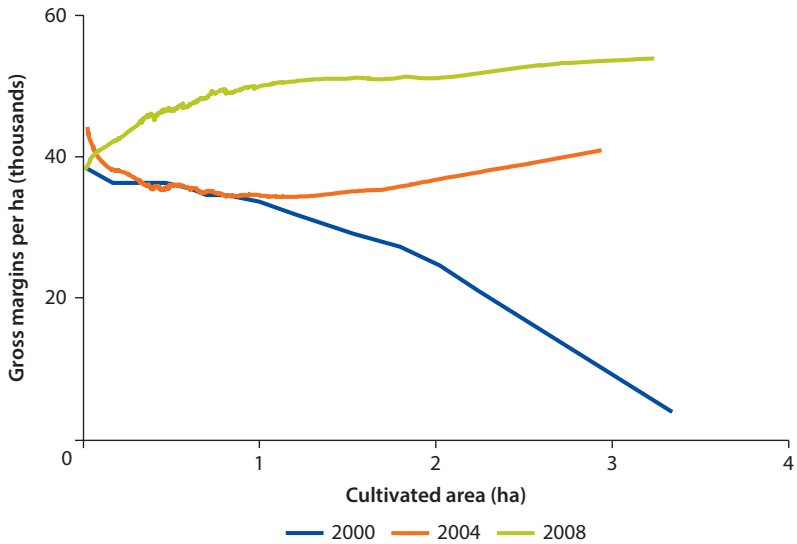
The empirical analysis of the previous sections provides evidence on the crucial role of connectivity in triggering productivity and efficiency in previously lagging regions of the country. It also highlights a number of processes within agriculture that are critical to building resilience. Among these, four strategically important issues are highlighted: the changing relationship between farm size and returns to farming, mechanization, changes in technology, and diversification.

Changing Production Relations: Farm Size and Returns to Farming

The panel structure of the MH surveys allows a unique insight into what appears to be a dramatic shift in the traditional production relations in agriculture. The efficiency analysis showed technical efficiency increasing with farm size—not a traditional finding, but readers should keep in mind the extremely small size of farms in Bangladesh. Using the panel survey data to estimate gross margins at the farm level (returns to family labor and land), the trends also show that the traditional inverse relationship between farm size and returns to farming appears to have changed (figure 3.11). This shift is significant, especially considering that the panel surveys cover such a short period (eight years), and it appears to be driven primarily by increased diversification on the relatively larger farms.

Although the value of output per hectare (or land productivity) declined with farm size in 2000, in 2008 no trend was apparent, which is indicative of constant returns to scale. When costs of inputs other than family labor and own land are taken into account, however, the gross margins show a shift from an inverse

Figure 3.11 Relationship between Gross Margins and Farm Size, 2000–08



Source: World Bank calculations using MH panel survey data.
Note: ha = hectares.

relationship in 2000 to a more flat one in 2004 and a positive one in 2008. The trend levels off just beyond the 0.5-hectare threshold, suggesting that some farms may perhaps be getting too small.

This changing relationship between the viability of small farms and the earlier results on the strong negative effects of fragmentation, combined with the positive impact of renting on farming efficiency, underscores the need to pay more attention to the smooth functioning of land markets, especially for leasing in land. As urbanization proceeds, pressure to convert farm land to other uses will increase (in fact, this pressure already appears to be occurring). These developments add to the urgency of ensuring that farm productivity is maintained and improved, both through further technological advances and through more efficient use of this scarce resource.

Mechanization

With limited scope for land expansion and labor increasingly seeking nonfarm work, intensive farming through more mechanized farm operations becomes imperative. Mechanization has indeed expanded rapidly since 1989, when the removal of restrictions on machinery imports and the standardization of agricultural machinery spurred a rapid increase in machinery imports and marketing by the private sector (Mandal 2014). Evidence from the MH panel surveys shows that since 2000 a vast majority of households are using some form of mechanization. Rapid farm mechanization has had a strong, positive impact on labor and land productivity in Bangladeshi agriculture (table 3.14). Farmers have readily adopted small machinery (such as power tillers and small tractors), which has

Table 3.14 Farm Mechanization and Farm Performance Indicators, 2000–08
values in 2008 prices

	2000		*2004*		*2008*	
	Nonadopter	*Adopter*	*Nonadopter*	*Adopter*	*Nonadopter*	*Adopter*
Farm households (number)	386	755	226	1,023	128	1,003
Farm households (%)	33.83	66.17	18.09	81.91	11.32	88.68
Output (per ha)	56,793	68,271	47,471	67,893	68,852	80,343
Crop diversification index	0.171	0.215	0.168	0.166	0.135	0.175
Farm efficiency score	0.736	0.757	0.767	0.757	0.727	0.734
Gross margin (per ha)	33,421	35,700	29,424	35,853	59,377	66,185
Hired labor cost (per ha)	6,913	11,355	4,797	10,167	12,142	12,141

Source: World Bank calculations using MH panel surveys.
Note: ha = hectare.

allowed them to release labor for other (mostly nonfarm) activities and diversify their incomes, while becoming more productive, efficient, and achieving higher gross margins on the farm.

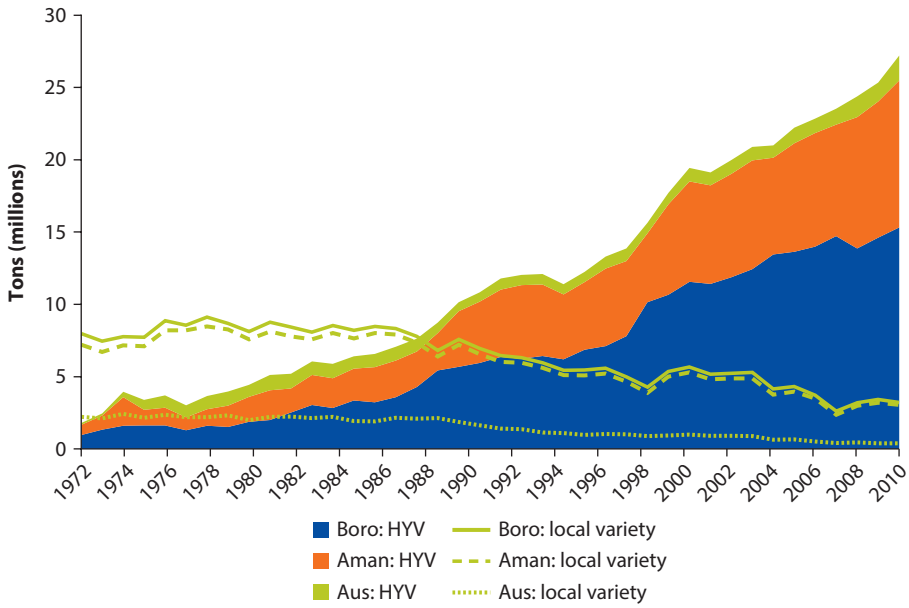
The shortage of labor (family) and access to electricity have been important drivers of farm mechanization, along with proximity to infrastructure and services (using distance to Thana and public transport as proxies; see Gautam and Ahmed 2015). The finding that tenurial arrangements and holding size are not strongly correlated with the adoption of mechanization indicates widespread use of mechanization. Thriving leasing and rental markets have allowed easier access to farm machinery, with significant positive impacts on agricultural productivity; 80 percent of households use mechanization, and of those, the vast majority (over 95 percent) are renting in machine services.

Changes in Technology

Since the early days of the green revolution in the 1960s and 1970s, technology has consistently and steadily driven growth and agricultural productivity. Policy reforms in the 1980s and 1990s created the enabling environment for the private sector to become a key driver of agricultural growth, particularly in the crops subsector. Water use (especially use of private shallow tubewells), fertilizer markets, access to improved seed, and better functioning output markets all significantly helped to improve the performance of agriculture in various phases of its growth.

Given the dominance of rice in agriculture, the most prominent contribution of technological change has occurred in rice production in the form of high-yielding rice varieties. In addition to delivering varieties with higher yield potential in the early years, research has continuously expanded rice production in different agroecologies; prominent recent contributions that have helped to maintain aggregate growth in rice production include the development of varieties that tolerate salinity and a high-yielding variety of aman. Figure 3.12 depicts the impressive, continuous shift in the composition of rice production, from risky rainfed *aus*[13] to boro rice as irrigation spread and cropping intensity increased, as well as from lower- to higher-yielding varieties. Long-term changes

Figure 3.12 Changes in the Composition of Rice Production, 1970s to 2010s



Source: BBS.
Note: HYV = high-yielding variety.

in the performance of rice by variety in terms of area, yield, and output are given in annex 3A, tables 3A.2 and 3A.3.

A large number of modern, high-yielding varieties have been developed by the national agricultural research system.[14] Among crops, rice has received the most attention over the years, with the release of 78 varieties for various seasons and ecologies between 1972 and 2013. The adoption of improved varieties is widespread; in 2013 almost 99 percent of boro rice production and 80 percent of aman and aus rice production came from improved varieties. Of the 78 varieties released, a few have remained popular with farmers. The most popular aman variety, released in 1980, is BR11 (covering 18 percent of the aman area). The most popular boro varieties, both released in 1994, are BRRI Dhan 28 and BRRI Dhan 29 (covering 32 percent and 35 percent of the boro sown area, respectively).[15] A few Indian varieties such as Swarna and Shatabdi have moved into Bangladesh through farmer-to-farmer exchange because of their special characteristics, such as improved grain quality, shorter time to maturity, and performance under low levels of input use. The widely popular Swarna covers about 14 percent of the rice area in border districts during the aman season (data from the Department of Agricultural Extension).

The production frontier has advanced in recent years with the introduction of hybrids, mostly from China. A substantial number of farmers have started growing hybrid rice, which now covers almost 14 percent of the boro area. At the same time, some private firms in Bangladesh have started producing seed of

Table 3.15 Characteristics of Popular Improved Rice Cultivars

Characteristic	*BR11*	*BRRI Dhan 28*	*BRRI Dhan 29*	*Hybrids*	
Year of release	1980	1994	1994	Various	2010
Growing season	Aman	Boro	Boro	Boro	Aman
Plant height (cm)	115	90	95	Approx. 1 m	112
Growth duration (days)	145	140	165	115–35	118
Average yield (t/ha)	6.5	5.5	7.5	8.0–9.0	6.5

Sources: BRRI 2015; Hossain and Bayes 2009.
Note: cm = centimeters; ha = hectare; m = meter; t = tons (metric).

hybrid rice (and maize) through contract farming. Major characteristics of the improved rice cultivars are noted in table 3.15.

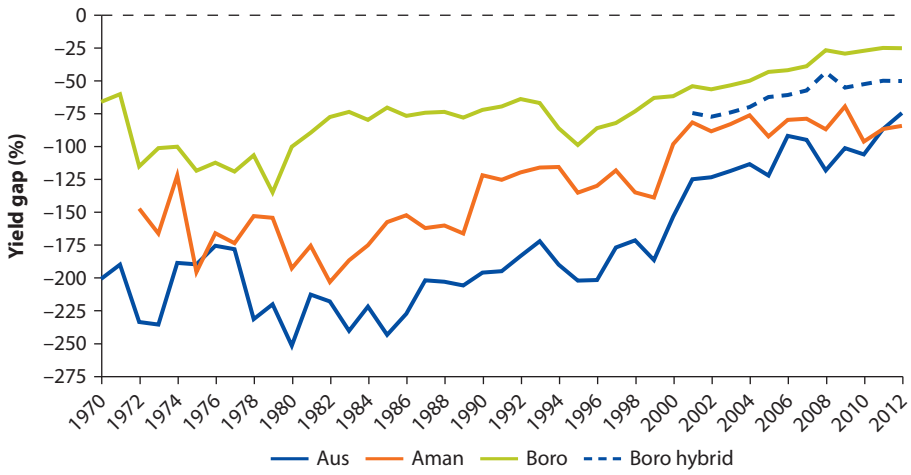
Yield Gaps

The higher yields, reduced unit production costs, and increased profitability of rice farming have been powerful drivers of the gradual adoption of new rice technologies (in the form of modern varieties) and replacement of low-yielding traditional varieties. These findings are consistent with the findings from the decomposition of TFP, which also showed that technological progress has been a major driver of productivity growth. The natural question that arises is how much more room there is for farmers' yields to grow. The prospects for future growth lie in the current yield gaps—in improving the average yields currently obtained by farmers to approach the potential yields reported for those same varieties by BRRI (the Bangladesh Rice Research Institute). Using the maximum yield potential of the varieties released since the early 1970s (obtained from data on yield potential of those varieties published by BRRI), figure 3.13 shows the closing of the yield gap in aman, aus, and boro rice.[16]

The yield gaps in figure 3.13 are based on national average yields for aus, aman, and boro. Even with the impressive progress in yield potential and adoption of improved varieties, it appears that farmers could still substantially improve the yields they obtain from their current technology for aus and aman. Yield gaps remain very large—more than 75 percent for each of the two seasons. The current boro yield gaps are about 25 percent for nonhybrids and about 50 percent for hybrids. The room to close those gaps may be limited, however, considering that almost no country has been able to reduce the yield gap below 20 percent (Fischer, Byerlee, and Edmeades 2014). Given strong consumer and producer preferences, the feasibility of further adoption of hybrids remains to be seen, but some potential remains for further yield gains in hybrid boro.

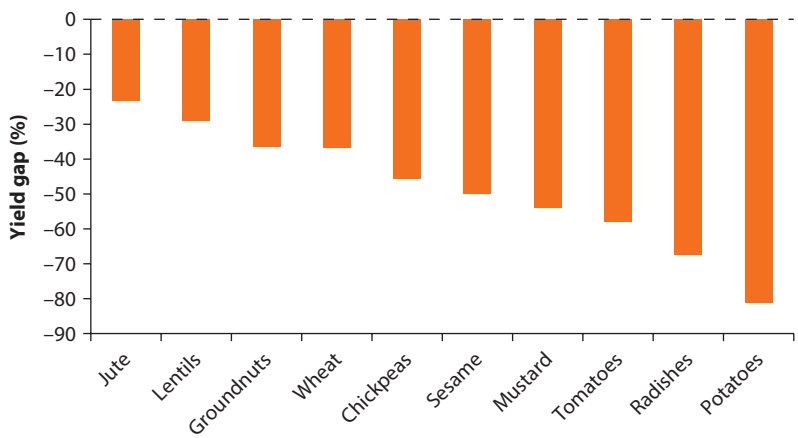
For crops other than rice, current yield gaps also remain substantial, with significant room for improvement in most crops except jute and lentils (Mondal 2011) (figure 3.14). While new varieties have been introduced for some crops, progress in expanding yield potential has been more limited. Past efforts have understandably focused on rice, with good results, but research now needs to give more attention to other crops and promote diversification and growth.

Figure 3.13 Progress in Closing Rice Yield Gaps, 1970–2012



Source: World Bank calculations using data from BRRI (2015).

Figure 3.14 Yield Gaps for Crops Other than Rice



Source: Mondal 2011.

The analyses described here have important policy implications. First, given the widespread adoption of high-yielding varieties in all three seasons (it is almost 100 percent for boro), future yield gains will come mostly from providing better extension services to close the knowledge and skills gap that appears to be keeping farmers' current yields well below their potential, despite widespread use of high-yielding varieties. Second, for boro and for stressed environments, which have been the main engine of past growth in overall production, the priority is to invest in research to continue to expand the production frontier (potential yields). Finally, crops other than rice urgently require more attention from research to expand yield frontiers in addition to addressing specific biotic and abiotic stresses afflicting these crops.

Seed Sector Development

Seeds embody technological change and are at the core of the productivity agenda. Improved varieties have driven past success in raising productivity and achieving food security. The focus now has to be on consolidating the gains in rice (maintaining and improving rice yields) while diversifying into higher-value and nutrient-rich crops. The latter have received little attention in the past. The most prolific release of varieties has been for hybrid rice, maize, and vegetables—mostly by the private sector (Naher and Spielman 2014).[17] Farmers have readily adopted the new varieties, indicating that they are not averse to purchasing seed.

Naher and Spielman (2014) lay out steps to reduce the remaining barriers to developing a more robust seed sector. First, public sector research must focus more strongly on crops other than rice. Second, level the playing field for the private sector to operate, and explore prospects for public-private partnerships to spur the development of better varieties of open-pollinated crops. Third, rationalize the cumbersome, lengthy process for registering new varieties, giving attention to harmonizing varietal testing with India and other suitable countries.

In addition to traditional genetic improvement research, the responsible application of biotechnology offers potentially huge gains for agriculture, especially considering the significant biotic and abiotic stresses encountered in different parts of the country.[18] A carefully considered policy needs to be in place—along with regulations under international standards of biosafety—along the lines of the Cartagena Protocol on Biosafety.

Fertilizer Use

Fertilizer use has increased significantly, tripling in terms of total fertilizer applied per hectare between 1980 and 2011. The growth rate has varied over time, but except for 2008 and 2009, following global spikes in fertilizer prices, fertilizer use has increased steadily over the past three decades. As discussed, fertilizer policy underwent significant changes over the same period, moving from state control to complete liberalization and then reverting since the mid-1990s to government intervention. The sector is now also subsidized, at substantial public cost. Past subsidy policies have favored nitrogenous fertilizers, leading to a significant imbalance in the use of nitrogen relative to other nutrients. In recent years, the government has addressed concerns about resource degradation resulting from an overuse of nitrogen by increasing subsidies for the other two macronutrients: potassium and phosphorous.

Household data are useful for assessing the effectiveness of fertilizer use on rice (boro and aman): identifying where fertilizer intensity is highest and demonstrating the impact of interventions in fertilizer markets. As expected, subsidies encourage farmers to use fertilizer, but at the current prices a substantial number of farmers are applying too much fertilizer—so much that the additional application is not translating to additional production per hectare, as seen in the simple statistics in table 3.16. The median farmer appears to be using

Table 3.16 Fertilizer Use Intensity and Yields of Boro and Aman Rice, 2004 and 2008

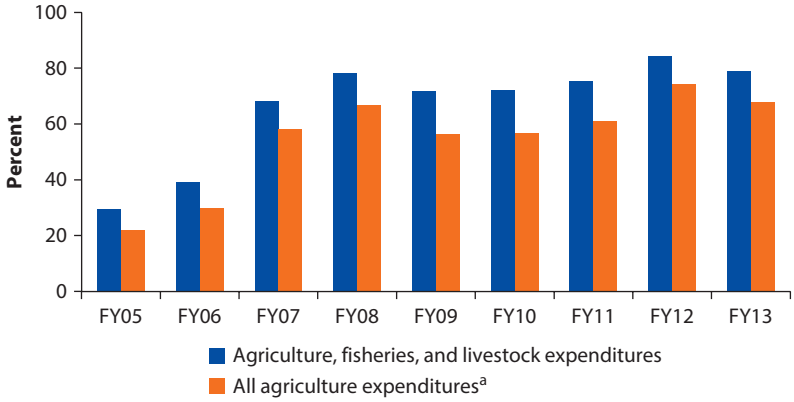
	Boro season			
	Average yields (kg/ha)		*Fertilizer use per ha (mean)*	
Intensity percentile	*2004*	*2008*	*2004*	*2008*
Top 10th percentile of fertilizer users	5,268	5,746	576.7	541.9
Top 25th percentile of fertilizer users	5,218	5,695	511.4	479.0
Median: 50th percentile of fertilizer users	4,906	5,820	342.5	340.2
Bottom 25th percentile of fertilizer users	4,665	4,986	194.6	216.6
	Aman season			
	Average yields (kg/ha)		*Fertilizer use per ha (mean)*	
Share	*2004*	*2008*	*2004*	*2008*
Top 10th percentile of fertilizer users	2,808	2,818	401.4	362.4
Top 25th percentile of fertilizer users	3,159	3,051	317.8	303.3
Median: 50th percentile of fertilizer users	3,151	2,823	175.5	168.3
Bottom 25th percentile of fertilizer users	2,571	2,230	81.3	75.7

Source: World Bank calculations using MH panel surveys.
Note: Fertilizer use per ha is kg of commercial products per ha. ha = hectare; kg = kilograms.

close to the recommended amount of fertilizer (a composite aggregate quantity of commercial product consistent with the recommended content of nitrogen, phosphorus, and potassium). A farmer using the recommended level of fertilizer in 2008 could expect to produce about 5.8 tons of paddy per hectare. The incremental yield gains between users at the 25th percentile of fertilizer intensity and those at the median level of intensity are significant, but higher levels of application are not beneficial—yields obtained between the 50th and the 75th or 90th percentile of fertilizer users are either lower or the same. This finding holds for both boro and aman rice. High fertilizer use thus does not appear to be translating into productivity gains, and it may actually be contributing to current and future declines in productivity through resource degradation. Excessive applications of nitrogen and other fertilizer chemicals can compromise sustainability and provoke the degradation of critical soil and water resources by leaching into groundwater or washing into rivers and streams.

Findings such as these raise questions about the most effective use of public expenditures, especially since some priority areas, such as extension and advisory services and other tried-and-tested productivity-enhancing investments, need additional support. Public expenditure on fertilizer subsidies has increased significantly in recent years, partly to rebalance nutrient use, but even so, fertilizer use remains very high.[19] The magnitude of the public expenditure on fertilizer subsidies is shown in figure 3.15 as a share of recurrent public expenditures since 2005–06. For the past three years, subsidies amounted to an overwhelming 80 percent of the public recurrent expenditures for agriculture, livestock, and fisheries put together (World Bank 2015).

Figure 3.15 Fertilizer Subsidies as Share of Recurrent Public Expenditures on Agriculture, FY05–FY13



Source: Ministry of Finance, Bangladesh.
a. Includes expenditures by the Ministries of Agriculture, Environment and Forests, Fisheries and Livestock, Water Resources, and Land.

Diversification

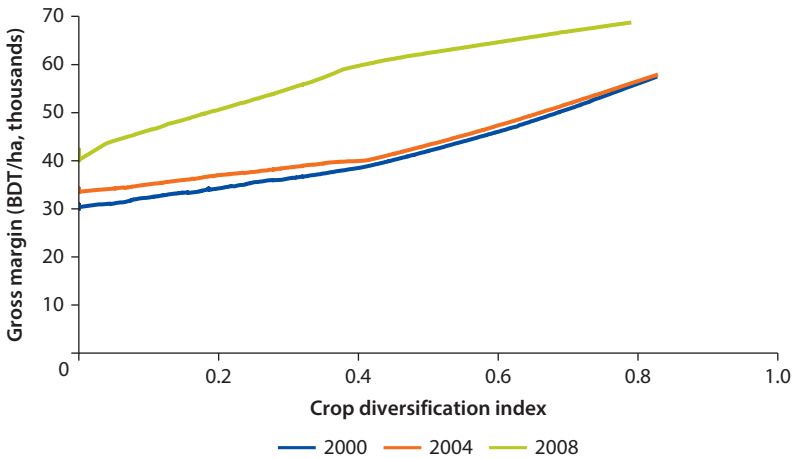
The past focus on food security has made rice self-sufficiency an overriding objective of agricultural strategies. Looking to the future, diversification into high-value agriculture is a priority for faster productivity and income growth, but it is important to neither neglect nor overemphasize the rice sector. This objective is feasible by exploiting the remaining yield gaps, but it will require investments in traditional and nontraditional technologies and leveraging the private sector to move the current technology frontiers.

Bangladesh has a comparative advantage in growing aman rice at export parity, indicating significant potential to profitably increase rice production (Shahabuddin 2002; Hossain and Deb 2009). This shift would help free boro areas for a more diverse range of high-value crops (such as vegetables, roots, and tubers) that are more suited to the winter boro land. Aside from boosting productivity and income, this approach has the advantage of reducing boro's environmental footprint by making more productive use of the increasingly scarce groundwater presently used to irrigate boro rice (Amarasinghe et al. 2014).

Policies shaping the relative incentives for rice and other crops must be reassessed to help make this change happen. Support prices, price stabilization, and public procurement, import, and distribution—even though seemingly small in magnitude—likely have a large influence on market outcomes, potentially distorting incentives facing farmers.

Another important factor for diversification is infrastructure development. By significantly improving connectivity with major urban centers, the Jamuna Bridge unlocked a big increase in the production of high-value agricultural produce, such as vegetables, to meet urban needs, and in the process catalyzed

Figure 3.16 Farm Gross Margins and Production Diversity



Source: World Bank calculations using MH panel surveys.
Note: BDT = Bangladesh taka; ha = hectare.

related changes in diversification, land markets, and mechanization. Road network development has also promoted diversification in agriculture, but not all farm households have diversified production or seem able to do so. Farm households with landholdings around the median are more diversified than households with large or small holdings. More than half of the households show no diversification, however, remaining heavily invested in rice in terms of land allocation despite opportunities to earn more income by producing crops other than rice. Figure 3.16 shows the strong positive relationship (consistent over time) between gross margins from agriculture and production diversification (using the area-based Simpson Diversity Index).

Agroecological, socioeconomic, and household characteristics also influence the diversification levels. For example, in low-lying, flood-prone areas, rice alternatives may be limited because other crops cannot tolerate so much water. But in favorable areas, at least at the lower end of the farm scale, diversification can significantly increase farm incomes. In general, the western divisions have a higher level of diversification, given their agroecological advantages in growing high-value horticultural crops. This comparative advantage was augmented after the Jamuna Bridge opened, and Rajshahi, Rangpur, and Khulna were especially active in diversifying production. This diversification has been a strong driver of income growth and significantly contributed to poverty reduction. Diversification has also increased significantly in Barisal, but appears to be declining in Dhaka, Chittagong, and Sylhet.

Conclusions and Implications

Bangladesh has come a long way from the dire outlook of the 1970s to achieve self-sufficiency in rice. But agriculture's role is significantly larger than providing rice. It is changing from being a direct or primary contributor to economic output

toward a more leveraged contribution. Powerful farm-nonfarm linkages, long recognized in development economics, continue to be an important factor behind agriculture's significant contribution to poverty reduction in Bangladesh.

Agriculture's performance has improved steadily over the past three decades, but within agriculture, little structural change has occurred. Crops still dominate, accounting for 58 percent of sectoral GDP. Farmers have not greatly diversified their crop choices. Rice occupies 77–80 percent of cultivated area; in fact, the area under paddy increased in recent years, contrary to what may be expected or desirable. Better rice varieties and better price incentives in recent years are likely to be responsible for reversing the diversification out of rice. At a more disaggregated level, the spatial picture shows some variation: diversification in eastern areas (Chittagong, Dhaka, and Sylhet) is lower than in western areas (Barisal, Khulna, and Rajshahi).

For nonrice crops, recent changes reflect both demand and consumer preferences and local agroecological endowments. The traditional nonrice crops (other cereals, pulses, oilseeds, and sugarcane) are giving way to maize, potatoes, and vegetables; jute has undergone something of a renaissance. Change is particularly noticeable in the western districts, where horticultural production has expanded more rapidly. These changes reflect economic efficiency gains since the structure is evolving toward crops in which Bangladesh has a comparative advantage.

The livestock and fisheries subsectors are strategically important for Bangladesh—for smallholders' incomes, creating jobs, and improving nutrition. Although GDP data show only a modest 2 percent annual rate of growth for the livestock subsector, production of the three main livestock products—milk, eggs, and meat—has grown at exceptionally high rates in recent years. The slow growth in livestock numbers (poultry, goats, sheep, and cattle) suggests that technology, such as improved breeds and disease control, is driving gains in livestock productivity. The fisheries subsector has performed much better and more consistently. Within the fisheries subsector, production has shifted from the traditionally dominant capture fisheries to culture fisheries. Culture fisheries now provide more fish (52 percent) than capture fisheries (48 percent).

Agroecological conditions are a critical factor in agriculture. Analysis based on clusters of areas with a common set of agroecological traits indicates that crop agriculture has grown the most in the plains, beel cluster, and Barind clusters, with irrigation and technology driving rice production (high-yielding boro varieties). Agroecology also determines the potential for crop diversification. Regular flooding makes low-lying or flood-prone areas unsuitable for growing vegetables, fruits, and cash crops. Crop diversification is thus lowest at low elevations and relatively high at medium and high elevations.

What have been the drivers of agricultural growth? Agricultural growth has been primarily rooted in productivity improvements, driven by policy reforms and strategic investments. The rapid spread of groundwater irrigation, new technology (seed and fertilizer), investments in better road connectivity, more efficient markets, and increased mechanization have all gained impetus from important policy reforms since the early 1980s.

During the mid-1980s, the government undertook major reforms in agricultural input markets, starting with the liberalization of fertilizer markets, followed by irrigation and farm machinery import regulations and seed sector reforms. The early 1990s also saw bold reforms in output markets, with large benefits to Bangladesh in terms of low and stable food prices. Some of these policies have been partially reversed since then, but the growth momentum continued because of the cumulative effect of the reforms and the continued development of technology. Some of the momentum may be waning, however, with subsequent policy reversals in the fertilizer, seed, and food grain output markets. In particular, the unintended consequences of some initiatives are becoming apparent. Fertilizer subsidies increased significantly following the food crisis of 2007 to keep domestic fertilizer prices low in the face of high world prices. They account for a large share of public expenditures, while the allocations to other public goods that are critical for enhancing productivity (such as extension and research, especially on nonrice crops, livestock, and fisheries) remain low. Farm-level analysis indicates that a significant share of farmers (as high as half) are overusing fertilizers, to the point where fertilizer use is not generating additional output. This wasteful use of fertilizers promotes resource degradation, which is contrary to the objective of increased productivity.

Technology has been the core driver of agricultural productivity since the green revolution days of the 1970s and 1980s. Technology has contributed most to rice production through the development and use of high-yielding rice varieties. Rice research has increased the yield potential in favorable areas and has continuously expanded to cover the other agroecologies where rice is grown; prominent recent contributions include varieties suited to saline conditions and a high-yielding variety of aman rice. Technologies have also been effectively transmitted to farmers' fields, so the gap between the highest yields achieved by researchers and the yields obtained by farmers is narrowing.

For future growth, significant unexploited potential remains for aman and aus. New hybrid varieties of boro are creating additional room for yields to grow (in a context where most farmers are already realizing most of the gains from nonhybrid varieties). Developing technology and closing the yield gaps for crops other than rice remains a very high priority. Here the role of the private sector needs to be exploited more. The private sector has been prolific in introducing new varieties of hybrid rice, maize, and vegetables—the areas of the seed sector where it has been allowed to operate more freely. Creating space for the private sector to participate more widely in developing technology is a high priority that can be achieved by removing the remaining regulatory and institutional barriers to participation.

The roles played by various factors in driving and sustaining production growth are clearly delineated in the analysis. A decomposition of the value of crop output shows the varying role of yields over time: they fell in the 1990s, constraining revenue growth for a decade, and then rose sharply in the mid-2000s to increase growth significantly through the late 2000s. As expected, the contribution of area has remained low. The low and fading contribution of

diversification is a concerning trend. The recent role of high prices may appear worrisome, but it should be seen as rebalancing the earlier decline in farmer incentives, and an important factor in driving recent growth and agricultural commerce. The real worry is the prediction that global prices will fall in coming years, highlighting the urgent need to focus on raising productivity and shifting into higher-value agriculture to maintain agricultural growth and poverty reduction.

Given the steady and substantial contribution of rising yields to agricultural growth, it is vital to understand how those increases have come about. From an economic and ecological sustainability perspective, TFP is the relevant measure to distinguish the contribution of inputs to output (yield) from the effectiveness with which the inputs are used to produce that output. TFP is further disaggregated into the contributions of technology and efficiency, which helps identify areas for additional policy attention.

The analysis shows a dramatic improvement in performance starting around 1995, when growth in TFP went from an anemic 0.2 percent to a remarkable 2.7 percent after 1995. Bangladesh's TFP growth since 1995 surpasses that of almost all South and East Asian countries; it is comparable to TFP growth in the best performer—China. The decomposition of TFP into subcomponents (technical change and efficiency) highlights two important trends. First, technical change has been the dominant driver of TFP, reflecting the impressive contribution of agricultural R&D. Second, technical efficiency shows a striking reversal from a declining to a rising trend in 1995, clearly demonstrating the far-reaching impact of sector and macropolicy reforms on the enabling environment for productive efficiency.

Farm-level analysis provides granular insights related to the changing organization of production, technical efficiency at the farm level (and its drivers), progress in mechanization, and structural change—with additional implications for policy. Bangladesh's agrarian institutions are changing under the pressure of market, social, and demographic forces to modernize and adapt. Tenancy contracts are a prime example. Exploitative sharecropping tenancy, which creates disincentives for agricultural investment and the adoption of modern, input-intensive technologies, is giving way to fixed-rent tenancy and medium-term lease arrangements. The traditional relationship between farm size and productivity also appears to be changing. Various indicators (negative impact of land fragmentation, farm size, and a positive impact of renting on efficiency) suggest that very small farms are now less efficient and less viable than the relatively larger farms—a significant shift from the traditional farm-size–productivity relationship, which further highlights the need to promote more efficient land markets. Access to public services is another important factor for efficiency improvements. Connectivity (roads and especially the Jamuna Bridge) had a strong stimulatory effect on productivity in the previously poorly connected parts of the country, especially the western districts. Similarly, access to electricity had a strong impact on raising farmers' technical efficiency.

These findings have a number of implications for strategy and policy:

- The agricultural strategy should neither neglect nor overemphasize the rice sector. Bangladesh has a comparative advantage in rice production, particularly in the aman season, which (given the remaining yield gaps) can be more fully exploited to increase production, even with the current technology. Analysis of comparative advantage suggests that in the winter season, production of most nonrice crops (particularly high-value horticulture) is economically efficient and may be a better option. A strategy of seasonal specialization (rice production alternating with high-value crops) would benefit farmers and consumers while safeguarding food security. The key is to level the policy playing field (addressing the distortions created by price support, procurement, and price stabilization) to create more balanced incentives across crops, and beyond crops for the noncrop subsectors.

- Time is opportune for Bangladesh to explore the most effective and efficient ways to support agriculture. There remains significant potential to increase productivity and incomes in agriculture, while making the sector more responsive to climate change and nutritional needs. Farmers remain heavily invested in rice, even as other crops and noncrop agriculture offer significantly higher incomes. To induce farmers to pursue agricultural enterprises other than rice production, their returns need to be further stabilized and solidified through tried-and-tested productivity-enhancing public investments, including research (especially on the long-neglected nonrice crops, livestock, and fisheries), water control and irrigation, and rural roads. Yet the much-needed public investment in these public goods remain very low, with the largest share of the public expenditure on agriculture now going to fertilizer subsidies. Past support has no doubt helped increase fertilizer use, but evidence now suggests that almost half of the farmers appear to be overusing fertilizer, and that additional fertilizer (beyond the dose recommended by research) is not apparently translating into additional output. Importantly, the overuse of fertilizer can entail large potential environmental and health costs, and in the long run it can compromise productivity itself through resource degradation. The priority must be to remove the remaining incentives that lead farmers to overuse inputs, in addition to providing them with technical advice.

- Technology has served Bangladesh extremely well; it is now urgent for research and advisory services to broaden their focus to nonrice and noncrop agriculture. The private sector is interested in some of these R&D areas, and the strategy should be to better leverage the contributions of the private sector, especially the private seed sector, more than in the past. In some areas, such as research to develop open-pollinated varieties, the private sector has less interest, because they are not commercially viable. In that case, public-private partnerships to complement public R&D are essential to move the

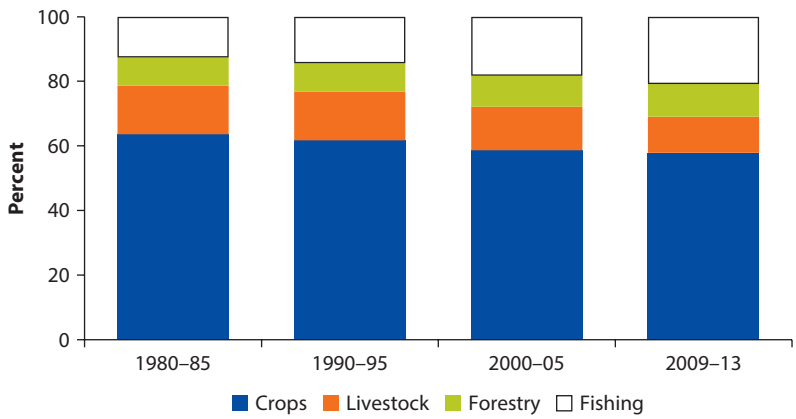
production frontier. The remaining regulatory barriers to more effective, wider private sector participation in the sector need to be removed.

- Food quality control measures must be strengthened, too. This topic is not analyzed in any depth in this report, but as previous analyses have established quite well, food quality and safety are critical to the growth of high-value agricultural products for both internal and external markets. Improved food safety, achieved through better sanitary and phytosanitary measures, results in better nutrition domestically and allows Bangladeshi products to compete in lucrative external markets that impose exacting quality standards.

- The fisheries, poultry, and livestock industries are strategically important for promoting more rapid income growth, creating rural jobs, and improving nutritional outcomes. These subsectors have historically received much less attention from policy and investment than their potential contribution to growth warrants. In the livestock subsector, development and increased productivity will depend on (a) increasing the productivity of small-scale producers; promoting commercial production; (b) providing extension advice, treating livestock diseases, and supplying other services to poor farmers; and (c) strengthening market linkages for small and poor farmers. The fisheries subsector requires separate sets of policies for capture and culture fisheries. For capture fisheries, appropriate community-based fisheries management is a priority. A cautious approach is needed to promote floodplain aquaculture. Technical assistance, with institutional and policy support, will be essential for sustainable development of aquaculture in Bangladesh. The availability of quality fish seed is a specific area that needs attention.

Annex 3A: Structure and Performance of Crop Agriculture

Figure 3A.1 Subsector Composition of Agricultural GDP, 1980–2013



Source: BBS, national accounts data.

Figure 3A.2 Change in the Structure of Agriculture: Area and Value of Output, 1990 and 2012

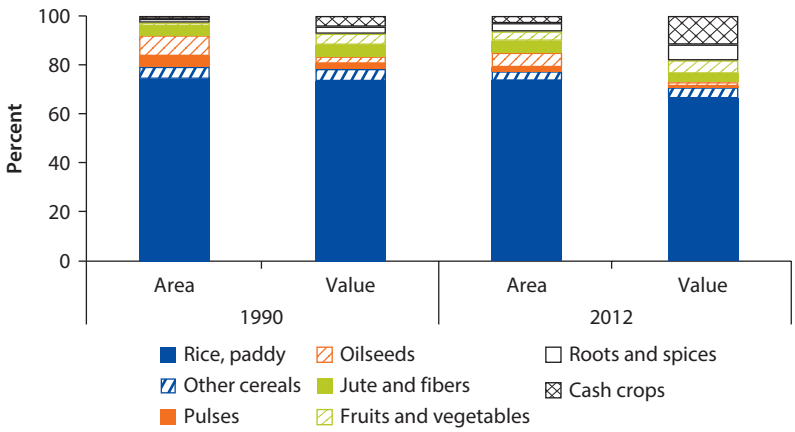


Table 3A.1 Trend Growth Rates in Area, Yield, and Production of Major Nonrice Crops, 1972–2010
percent

	1972–73 to 2009–10			*1972–73 to 1979–80*			*1980–81 to 1989–90*			*1990–91 to 1999–2000*			*2000–01 to 2009–10*		
Crop	*A*	*Y*	*Q*	*A*	*Y*	*Q*	*A*	*Y*	*Q*	*A*	*Y*	*Q*	*A*	*Y*	*Q*
Wheat	3.1	1.7	4.8	16.8	13.3	30.0	0.7	−2.1	−1.4	4.6	3.1	7.8	−9.4	0.4	−9.0
Pulses	0.0	0.7	0.7	2.5	−1.6	0.9	−2.7	0.8	−1.9	−3.1	0.4	−2.7	−9.5	2.2	−7.4
Oilseeds	0.8	2.3	3.1	1.5	0.5	2.0	−1.8	1.0	−0.8	−1.1	3.5	2.4	−1.8	11.8	10.0
Vegetables	3.5	1.1	4.6	1.9	−0.4	1.5	2.7	−0.6	2.1	4.3	−0.2	4.0	6.2	1.4	7.5
Potatoes	4.2	1.4	5.6	2.3	0.5	2.8	0.1	0.4	0.5	6.7	1.4	8.1	7.0	1.8	8.8
Spices	2.2	1.7	3.9	0.7	−2.0	−1.2	−0.3	2.2	1.9	5.8	−3.8	2.0	2.0	14.4	16.4
Tea	0.7	1.4	2.1	−0.2	6.0	6.2	0.7	−0.4	0.2	0.2	1.9	2.1	1.3	−0.3	1.0
Jute	−1.9	1.6	−0.3	−0.7	2.1	1.5	−1.0	1.9	0.9	−2.4	8.9	6.5	−0.7	1.9	1.1
Sugarcane	0.0	−0.1	−0.1	1.4	0.6	2.0	1.6	−1.4	0.3	−1.2	0.3	−0.8	−4.0	−0.4	−4.4

Source: Shahabuddin 2014.
Note: The trend growth rates have been computed by fitting semi-log function to the data. A = area; Q = production; Y = yield.

Table 3A.2 Trend Growth Rates in Area, Yield, and Production of Rice Crops, 1972–2010
percent

	1972–73 to 2009–10			*1972–73 to 1979–80*			*1980–81 to 1989–90*			*1990–91 to 1999–2000*			*2000–01 to 2009–10*		
Crop	*A*	*Y*	*Q*	*A*	*Y*	*Q*	*A*	*Y*	*Q*	*A*	*Y*	*Q*	*A*	*Y*	*Q*
Aus (local)	−5.9	1.4	−4.5	−1.7	0.9	−0.8	−3.2	1.9	−1.3	−6.3	0.2	−6.2	−12.1	0.5	−11.6
Aus (HYV)	2.0	−0.4	1.6	23.3	−3.4	19.8	−1.7	−2.7	−4.4	2.4	1.0	1.4	4.4	1.5	5.8
Aus (total)	*−3.9*	*1.8*	*−2.1*	*0.1*	*2.8*	*2.9*	*−2.9*	*0.8*	*−2.1*	*−4.1*	*0.9*	*−3.2*	*−3.7*	*2.4*	*−1.3*
Aman (local)	−3.0	0.6	−2.4	0.5	3.4	3.9	−3.0	1.2	−1.8	−2.9	−0.8	−3.7	−6.3	−0.6	−6.9
Aman (HYV)	6.1	0.5	6.6	2.3	0.6	2.9	5.5	0.8	6.2	2.3	−0.5	1.8	3.4	−0.2	3.3
Aman (total)	*−0.2*	*1.8*	*1.6*	*0.7*	*2.9*	*3.6*	*−1.2*	*1.9*	*0.7*	*−0.8*	*0.1*	*−0.7*	*−0.6*	*0.6*	*0.0*

table continues next page

Table 3A.2 Trend Growth Rates in Area, Yield, and Production of Rice Crops, 1972–2010 *(continued)*
percent

	1972–73 to 2009–10			*1972–73 to 1979–80*			*1980–81 to 1989–90*			*1990–91 to 1999–2000*			*2000–01 to 2009–10*		
Crop	*A*	*Y*	*Q*	*A*	*Y*	*Q*	*A*	*Y*	*Q*	*A*	*Y*	*Q*	*A*	*Y*	*Q*
Boro (local)	–3.7	1.1	–2.6	–3.8	–1.5	–5.3	–3.6	–2.4	–6.0	–2.5	1.4	–1.1	–7.5	0.3	–7.2
Boro (HYV)	6.6	0.9	7.5	4.6	–2.5	2.1	11.3	–0.7	10.6	4.2	1.8	6.0	3.5	0.8	4.4
Boro (total)	*4.8*	*1.8*	*6.6*	*0.8*	*–0.8*	*0.1*	*8.1*	*0.4*	*8.4*	*3.6*	*2.1*	*5.7*	*2.9*	*2.8*	*5.6*
Rice (local)	**–3.7**	**1.1**	**–2.6**	**–0.5**	**2.4**	**1.9**	**–3.1**	**1.2**	**–1.9**	**–3.8**	**–0.2**	**–4.0**	**–8.0**	**–0.4**	**–8.3**
Rice (HYV)	**5.8**	**0.8**	**6.6**	**6.1**	**–1.3**	**4.8**	**7.0**	**0.1**	**7.1**	**3.2**	**1.0**	**4.2**	**3.8**	**1.0**	**4.8**
Rice (total)	***0.2***	***2.6***	***2.8***	***0.5***	***2.3***	***2.8***	***–0.1***	***2.4***	***2.3***	***0.0***	***1.8***	***1.8***	***0.2***	***2.6***	***2.8***

Source: Shahabuddin 2014.
Note: The trend growth rates have been computed by fitting semi-log function to the data. A = area; HYV = high-yielding variety; Q = production; Y = yield.

Table 3A.3 Area, Yield, and Production of Rice Crops, 2010–13

	2010–11			*2011–12*			*2012–13*		
Crop	*Area (acres)*	*Yield (mds/ acre)*	*Prod. (t)*	*Area (acres)*	*Yield (mds/ acre)*	*Prod. (t)*	*Area (acres)*	*Yield (mds/ acre)*	*Prod. (t)*
Aus (local)	780,426	13.15	393,543	708,486	13.95	368,986	652,905	13.82	336,763
Aus (HYV)	1,969,589	23.66	1,739,278	2,103,957	25.00	1,963,166	1,949,392	25.03	1,821,474
Aus (total)	*2,750,015*	*20.78*	*2,132,821*	*2,812,443*	*22.21*	*2,332,152*	*2,602,297*	*22.22*	*2,158,238*
Aman (broadcast)	1,052,822	12.95	509,032	949,018	12.77	452,422	912,926	12.85	438,002
Aman (local transplant)	3,251,031	17.64	2,140,729	3,189,969	17.57	2,092,313	3,127,941	17.32	2,021,776
Aman (HYV)	9,647,080	28.16	10,141,737	9,650,145	28.47	10,253,533	9,822,394	28.47	10,437,432
Aman (total)	*13,950,933*	*24.56*	*12,791,498*	*13,789,132*	*24.86*	*12,798,268*	*13,863,261*	*24.92*	*12,897,210*
Boro (local)	195,300	22.21	161,903	179,012	20.93	139,847	162,957	22.50	136,836
Boro (HYV)	9,967,871	41.20	15,329,343	10,113,855	41.32	15,597,503	10,081,907	41.86	15,751,828
Boro (hybrid)	1,624,807	51.33	3,125,534	1,593,185	50.81	3,021,862	1,517,708	51.00	2,889,492
Boro (total)	*11,787,978*	*42.31*	*18,616,780*	*11,886,052*	*42.28*	*18,759,212*	*11,762,572*	*42.77*	*18,778,154*
Rice (local)	***5,279,579***	***16.26***	***3,205,207***	***5,026,485***	***16.27***	***3,053,568***	***4,856,729***	***16.18***	***2,933,377***
Rice (HYV)	***23,209,347***	***35.02***	***30,335,892***	***23,461,142***	***35.21***	***30,836,064***	***23,371,401***	***35.42***	***30,900,226***
Rice (total)	***28,488,926***	***31.54***	***33,541,099***	***28,487,627***	***31.87***	***33,889,632***	***28,228,130***	***32.11***	***33,833,602***

Source: BBS.
Note: HYV = high-yielding variety; mds = maunds; t = metric tons.

Table 3A.4 Agroecological Zones (AEZs) of Bangladesh

AEZ no.	*Name of AEZ*	*Crops*
1	Old Himalayan Piedmont Plain	Transplanted aman, wheat, potato, sugarcane
2	Active Tista Floodplain	Cheena, kaon, limited area of sugarcane
3	Tista Meander Floodplain	Tobacco, potato, vegetables, spices, aus, jute, wheat
4	Karatoya Bangali Floodplain	Wheat, potato, mustard, chili, HYV boro
5	Lower Atrai Basin	HYV boro

table continues next page

Table 3A.4 Agroecological Zones (AEZs) of Bangladesh *(continued)*

AEZ no.	*Name of AEZ*	*Crops*
6	Lower Punarvaba Floodplain	Deepwater aman
7	Active Brahmaputra Jamuna Floodplain	Aus, jute, deepwater aman, cheena, mustard, rabi pulses, rabi groundnut
8	Young Brahmaputra and Jamuna Floodplain	Jute, transplanted aman, wheat, barley, cheena, maize, kaon, mustard, groundnut, pulses, chili
9	Old Brahmaputra Floodplain	Sugarcane, wheat, lentil, potato, vegetables, khesari
10	Active Ganges Floodplain	Jute, sugarcane, khesari, lentil, chickpea, mustard, cheena, groundnut, chili, spices, tobacco
11	High Ganges River Floodplain	Aus, jute, sugarcane, tobacco, cotton, garlic, onion, banana, mango, HYV boro
12	Low Ganges River Floodplain	Aman, deepwater aman, tobacco, banana, spices
13	Ganges Tidal Floodplain	Aus, khesari, chili, coconut, HYV boro, betel leaf
14	Gopalgangs Khulna Bils [beels]	HYV boro, aus, jute, sesame, transplanted aman, sugarcane
15	Arial Bil [beel]	Mixed aus, pulses, mustard, wheat
16	Middle Meghna River Floodplain	Jute, HYV boro, groundnut, chili, mustard, wheat, khesari, sweet potato
17	Lower Meghna River Floodplain	Chili, potato, wheat, mustard, kaon, transplanted aman
18	Young Meghna Estuarine Floodplain	Aus, transplanted aman, khesari, lentils
19	Old Meghna Estuarine Floodplain	Aus, transplanted aman, HYV boro, wheat, potato, mustard, kaon, sesame, khesari
20	Eastern Surma Kusiyara Floodplain	Aus, transplanted aman, spices, sweet potato, potato, pulses, mustard
21	Sylhet Basin	Mustard, rabi vegetables
22	Northern and Eastern Piedmont Plains	HYV boro, deepwater aman, tea
23	Chittagong Coastal Plain	Deepwater aman, cowpea, coconut, betel nut
24	St. Martin Coral Island	Coconut, betel nut
25	Level Barind Tract	HYV aus, aman, potato, wheat
26	High Barind Tract	Broadcast aman, mustard
27	North Eastern Barind Tract	Sugarcane, aus, mesta, mustard, maskalai, potato, HYV boro
28	Madhupur Tract	Sugarcane, groundnut, mustard, potato, deepwater aman
29	Northern and Eastern Hills	Shifting Jhum cultivation to cultivate comilla cotton, rubber, tea, pulses, gourds
30	Akhaura Terrace	Aus, transplanted aman, jackfruit, HYV boro

Sources: FAO 1988; UNDP.
Note: HYV = high-yielding variety.

Notes

1. Average imports of rice in recent years have been equivalent to less than 2 percent of domestic production.
2. The volatility in agricultural growth has diminished significantly because about 80 percent of cultivated area is now irrigated and major floods have been few in recent years. Distinct episodes of strong subsectoral performance have also contributed to the

stability of overall agricultural growth. For example, from the 1980s through the 1990s, growth in the crops subsector was positive but slowed considerably. At the same time, the fisheries subsector did exceptionally well, contributing to most of the growth in agriculture and driving agricultural GDP higher despite the slowdown in the crops subsector. In the 2000s, growth in fisheries slowed, but crops initiated a strong recovery. Growth in the livestock and (to a lesser extent) forestry subsectors also accelerated.

3. Simpson Diversity Index is calculated as $\mathrm{SID} = 1 - \sum_{i=1}^{n} P_i^2$, where *Pi* is the proportionate area (or production value for a value-based index) of the i^{th}crop in gross cropped area (total production value).
4. The Agricultural Census database classified the current Rajshahi and Rangpur Divisions under the older classification as Rajshahi, and hence is reported as such.
5. Each micro-level data source has limitations, either in the coverage of crops or availability of price/value data. Most sources have data on the area under specific crops, which was compared for consistency across the Food and Agriculture Organization (FAO) database, Agricultural Census of 2008, and the BIHS 2011–12, as they are likely to be more representative than other sources.
6. See Shahabuddin (2014) and updates from *Bangladesh Economic Review* (Finance Division 2014).
7. Rising deficits, with competitive markets, will lead to higher prices if supply does not increase in response to rising demand.
8. *Inland open water bodies*, where capture fishing is mainly carried out, include rivers and estuaries, *beels* (small lakes, low-lying depressions, permanent bodies of floodplain water, or bodies of water created by rains or floods that may or may not dry up in the dry season; in the wet season, *haors* or shallow lakes may be formed as smaller water bodies are joined up), Kaptai Lake (a humanmade lake created for hydroelectricity), and floodlands (annually flooded, low-lying areas associated with rivers). *Inland closed water bodies*, where aquaculture (fish farming) at various intensities is carried out, include ponds, *dighis* (big ponds), and *haors* (oxbow lakes), and also some coastal waters. The fisheries subsector also includes brackish water shrimp and prawn production in coastal areas. *Marine fishing* takes place in waters extending over 166,000 km^2 (16.6 million hectares) of sea area, following the 1974 declaration of a 200-nautical-mile exclusive economic zone (EEZ), within which Bangladesh also has the right to exploit and manage living and nonliving resources. Brackish water shrimp production occurs in coastal areas where shrimp are produced in artificial ponds, primarily for export.
9. The database used to delineate AEZs must be updated over time, owing to (a) changes in land types as roads and other structures are built; (b) changes in precipitation and temperature over time; and (c) innovations in crop production that make it possible for some crops to tolerate different stresses in the growing environment.
10. The Bangladesh Agricultural Development Corporation.
11. Rice sown or transplanted in spring or summer and harvested in November–December.
12. In the regression results reported here, the impact of markets is muted because this variable is correlated with distance to Thana. Consistent with this result, the impact of distance to market is highly negatively significant when village effects are controlled for.

13. Rice sown in March–April and harvested in the summer.
14. BRRI data on registered rice varieties; Hossain, Bose, and Mustafi (2006).
15. BRRI is the Bangladesh Rice Research Institute.
16. The yield gap is measured as the ratio of the difference between average observed (farmer) yields and potential (research) yields to the observed (farmer) yields. It thus gives the percentage increase relative to current observed yields.
17. In the postliberalization period, 1994–2012, the private sector registered 89 hybrid rice varieties, 98 maize varieties, and 1,064 vegetable varieties. During that same period, the public sector released 3 hybrid rice varieties, 19 maize varieties, and 116 vegetable varieties. The private sector has shown little interest in modern rice varieties (3 releases compared to 40 by the public sector) and pulses (4 releases compared to 50 by the public sector). For the other notified crops, the private sector is shut out from the seed industry, while public releases have been relatively few, with the exception of potatoes (27).
18. Bangladesh is the first country in South Asia to undertake field-testing of a Bt (genetically modified) variety of eggplant.
19. For example, household-level estimates show that the median urea application for boro is about 250 kg per hectare (consistently across the survey years), well above the recommended 200 kg per hectare (which is on the higher side, given fertilizer recommendations for more sites in Bangladesh). In other words, more than half of the farmers apply too much urea.

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CHAPTER 4

Growth of the Nonfarm Sector and Its Drivers

Introduction

The rural nonfarm (RNF) sector[1] is a key source of productive employment, especially before the formal nonfarm sector starts to absorb surplus rural labor (Chawanote and Barrett 2012; Timmer 2002), and many East Asian economies have shown that the RNF sector can also be a key driver of overall economic growth (Lanjouw and Lanjouw 2001; Lin and Yao 1999; McCulloch, Timmer, and Weisbrod 2007). In Bangladesh the farm sector has traditionally dominated employment and growth in rural areas, but the RNF sector has also long been recognized for its role in the growth of the rural economy (Bhattacharya 1996; Mahmud 1996; Sen 1996; World Bank 2007). The increased importance of the RNF sector as a source of household income, provider of employment, and driver of poverty reduction is discussed in chapter 2. The extremely narrow scope for expanding agricultural land, the growing and increasingly educated labor force,[2] and the growing demand for nonfarm goods and services all imply that future growth and poverty reduction in Bangladesh will require robust growth of the RNF sector.

For these reasons, investigating the factors affecting the performance and growth of the RNF sector is central to understanding the dynamics of rural growth. One hypothesis is that substantial public investments in infrastructure, such as roads and bridges and better communication technologies, will lead to better rural-urban linkages and facilitate the creation of jobs in services, trade, and microenterprises. Yet these outcomes could be the result of investments from many other sources, such as higher farm profits, remittances from migrants, better access to financing for micro, small, and medium enterprises, and transfer payments. An understanding of these dynamics is also important because literature on the growth of the RNF sector in Bangladesh (World Bank 2004) and the data used (Islam, Zohir, and Hossain 2011) are often dated, and earlier findings may not reflect current dynamics.[3]

The RNF sector is broad, covering all income-generating activities and other sources of income in villages, rural towns, and peri-urban areas, excluding the primary production of crops, fish, trees, and livestock. Aside from the services sector, where the more productive or higher-paying jobs tend to require substantial human capital (education or skills), the organized microenterprise and the small and medium enterprise (SME) sectors[4] appear to offer great potential for economic growth and rapid employment creation. A number of studies include remittances as part of nonfarm sources of income. As noted in chapter 2, detailed analysis of migration and remittances is beyond the scope of this study; it remains an important part of the future analytical agenda.

The following analysis particularly focuses on microenterprises—enterprises employing fewer than 10 employees—since they have traditionally dominated the RNF economy. Survey data from the 2001 and 2003 rounds of the Economic Census and the 2005 National Report of the Bangladesh Bureau of Statistics (BBS) suggest that 64 percent of enterprises and half of employment in manufacturing, trade, and service enterprises are in rural areas (Islam, Zohir, and Hossain 2011). Ninety-nine percent of rural nonfarm enterprises (RNFEs) are microenterprises, accounting for almost 90 percent of workers employed at RNFEs. Income from microenterprises appears to have a greater role in poverty reduction than other nonfarm sources of income (Deininger and Jin 2007; Khandker and Samad 2014). Although households with business enterprises appear to be better off (annex 4A, table 4A.1), a surprising finding from the Household Income and Expenditure Survey (HIES) data, discussed in chapter 2, is that the share of microenterprise owners among rural households declined from 2000 to 2010. Understanding why the decline occurred is an important outstanding question.

Changing Profile and Role of Rural Nonfarm Activities

A detailed profile of RNF activities in which rural households are involved is helpful for understanding the nature and drivers of these activities and their future prospects. A major challenge is that surveys vary in their definitions for the types of activities that households or individuals pursue and for their sources of income. A second major challenge is that households engage in multiple activities, both on and off the farm, and the shares of income from those activities change over time (table 4.1)—depending on the prevailing circumstances and the performance of sectors—making it difficult to categorize households by a single type of farm or nonfarm activity. As applicable, the analysis that follows uses total household income earned by all household members from various sources, rather than using the household head's occupation or income. If necessary, a household is classified by type of occupation based on the source of the majority of its income.

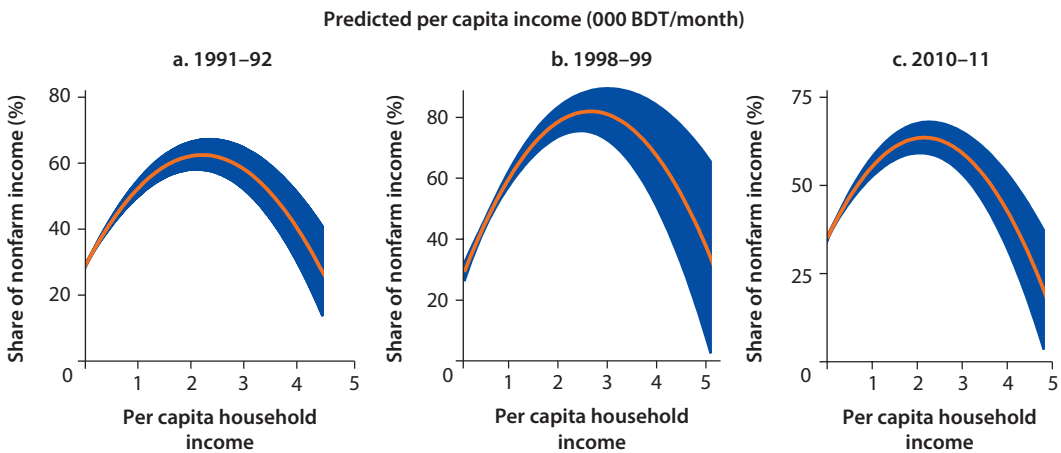
To understand the RNF profile, figures 4.1 and 4.2 show the relationship between nonfarm income and total household income. Both the HIES and WBI survey data show a similar nonlinear pattern for all survey years, with the share of nonfarm income initially rising and eventually declining with per capita household income.

Table 4.1 Share of Rural Households Earning Income from Different Sources, 2000–10
percent

Income source	*2000*	*2005*	*2010*
Crop farming	64.5	64.2	63.8
Noncrop farming	64.1	30.8	70.8
Agricultural wage	34.6	25.4	25.9
Enterprise	30.7	24.8	22.6
Wage and salary	26.5	41.8	36.2
Remittance	27.3	30.0	23.4
Other income	51.4	56.5	28.9
Total farm income	79.9	80.8	87.2
Total nonfarm income	83.1	89.1	77.4
Farm and nonfarm income	*62.9*	*69.9*	*64.5*

Source: BBS, HIES.

Figure 4.1 Trend in the Share of Nonfarm Income in Household Income (WBI Panel Data)



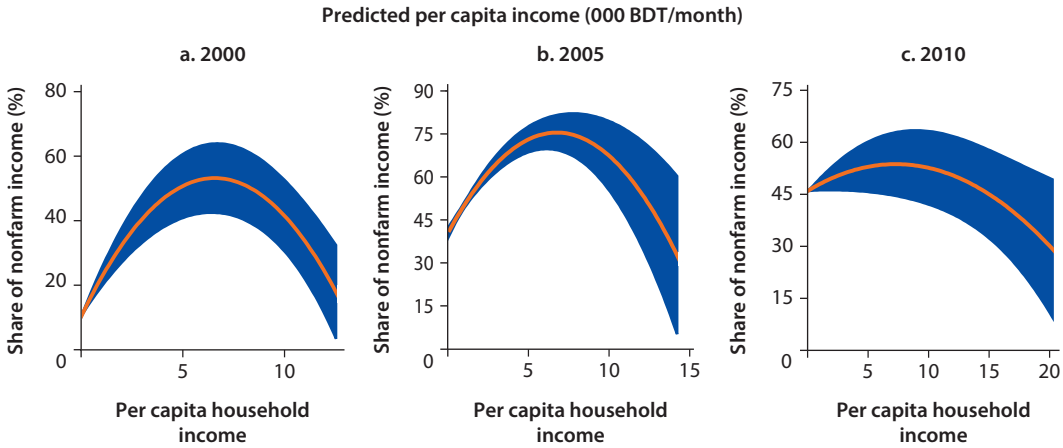
Sources: WB-BIDS surveys 1991–92, 1998–99; WB-InM survey 2010–11.
Note: Shaded area represents bandwidth for 95 percent confidence interval. BDT = Bangladesh taka.

Temporal and Spatial Patterns of Income

Figure 4.3 shows changes in the share of household income from different sources between 2000 and 2010. Within agriculture, noncrop agriculture has increased. Within the RNF sector, enterprise-based incomes declined somewhat, but households made a significant shift from "other" (undefined) sources to wages and salaries, indicating a sharp rise in service- and wage-based RNF activities.

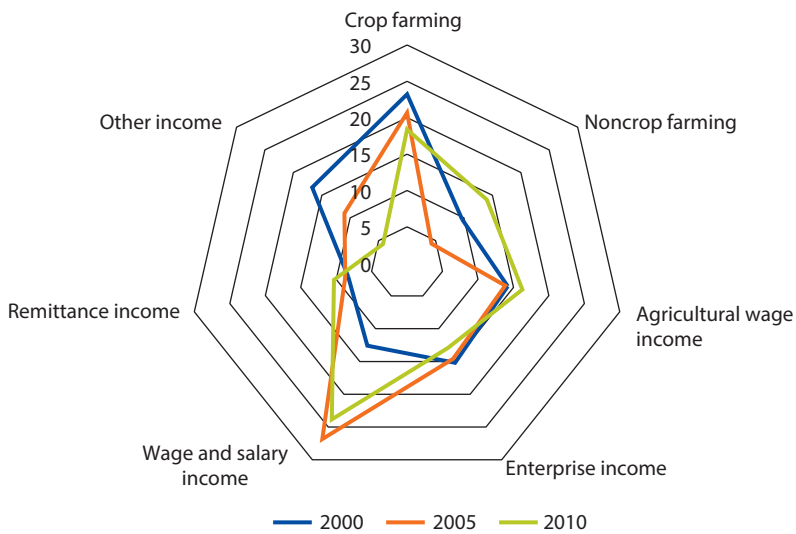
Patterns in income sources have an important spatial dimension. To show the effects of proximity to urban areas—traditionally the major stimulant for RNF

Figure 4.2 Trend in the Share of Nonfarm Income in Household Income (HIES Data)



Sources: BBS, HIES 2000, 2005, 2010.
Note: BDT = Bangladesh taka.

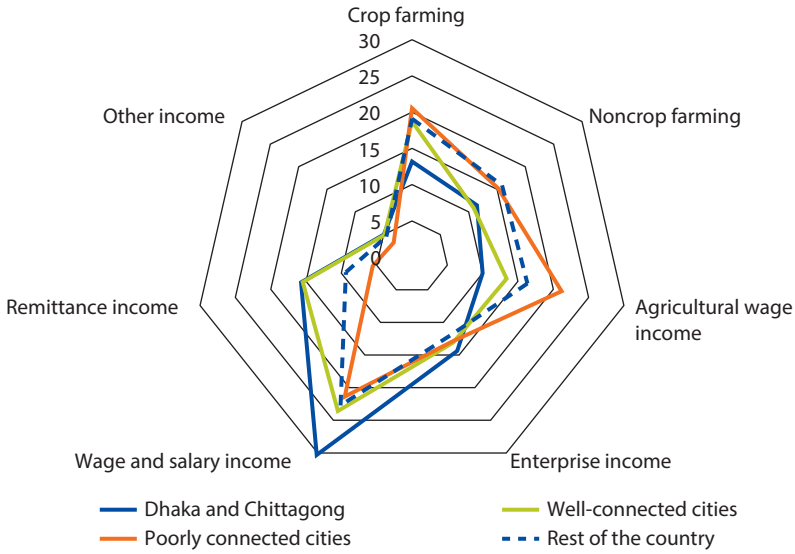
Figure 4.3 Change in Rural Income Sources, 2000–10
percent



Source: BBS, HIES 2000, 2005, and 2010.

jobs—and the effects of connectivity (in terms of road access to Dhaka), figure 4.4 shows how income patterns vary depending on whether households are located close to Dhaka and Chittagong (defined as living in districts adjacent to Dhaka and Chittagong), close to secondary cities with good connectivity, close to cities with poor connectivity, or in the rest of the country.

Figure 4.4 Spatial Profile of Income Distribution, 2010
percent



Source: BBS, HIES 2010.

Households living near Dhaka and Chittagong—and households in better connected cities—rely significantly more on wages and salaries and have higher remittance incomes than those living in poorly connected or mostly rural settings. The share of enterprise incomes is surprisingly uniform across spatial settings, and relatively low.

Rural household activities have changed significantly over time. Nonfarm activities have always been a part of the rural economy in Bangladesh; traditionally they have consisted of crafts and cottage industries (which supplied utensils, storage pots, clothing for day-to-day use, and numerous other items) and personal services. Some traditional crafts and cottage industries required a significant level of skill and artistic sophistication; the locally produced muslin cloth was appreciated throughout neighboring countries, Europe, and the Far East. Groups that had settled in a particular area and perhaps belonging to particular Hindu castes specialized in various crafts. For example, bamboo products, metal items, clay items, and livestock products were provided by castes specializing in their production for countless generations. Over time, as caste boundaries weakened or blurred, this specialization declined, and the technology used in many traditional activities changed dramatically. As new marketing channels opened, cheaper, mass-produced products of modern manufacturing increasingly replaced traditional crafts.

During recent decades the RNF sector expansion in Bangladesh therefore includes the development of activities in new sectors and subsectors. New needs and demands in agriculture, both upstream and downstream (that is, in input and output markets), have introduced new value chains and processing activities

(modern rice milling, feed preparation, agroprocessing, and the like) and growth in trading and related services for the use of modern inputs (including leasing and rental markets for machinery and primary processing, and services for maintaining and renting that equipment).

In Bangladesh, few RNF activities are now based on the use of natural raw materials. Therefore the concentration of nonfarm activities may be the outcome of three factors. First, it may be based on traditional skills, which may be concentrated in certain regions. Second, RNF activities may become concentrated in areas where workers have been pushed out of farm activities by the limited availability or poor quality of land. These areas would offer cost advantages resulting from lower wage levels. A third possibility is that higher incomes (from agriculture or from other sources like remittances) in some areas may increase the demand for nonfarm goods and services.

Nature of Rural Nonfarm Activities

Data indicate that RNF activities include a highly heterogeneous collection of trading, commercial, and service activities, agroprocessing, and manufacturing. Developing a detailed profile of the nonfarm sector and its drivers is hampered by a lack of data, as noted, and by the challenges presented by the available data: (a) the classification of activities varies by data source; and (b) researchers have used different lenses to look at RNF activities and employment. Although these limitations mean that only a broad profile of the nonfarm sector can be pieced together, it is nevertheless useful.

At the national level, using HIES data, the shares of RNF workers engaged in different activities show that the broad structure of employment has not changed significantly since 2000 (table 4.2). Manufacturing (aggregated across categories), trade, transport, and high-skilled services are the main activities of rural households. Within the services sector there is a small shift from low-skilled to high-skilled jobs and an increase in construction jobs. Among manufacturing jobs the largest share is in the handloom and tailoring business.

Hossain (2004) makes a useful distinction among RNF activities by classifying them as based on (a) manual labor, such as self-employment in cottage industries; (b) human capital, such as salaried work; and (c) physical capital, such as businesses or enterprises like shopkeeping and trading. World Bank (2004) provided another profile of the nonfarm sector based on a survey in 2003.

As for the relative size and trends of farm and nonfarm activities, an updated version of the employment patterns from Hossain (2004), extended to include later years of the MH panel surveys, is presented in table 4.3, showing how the same rural households have fared over time. Nonagricultural jobs have grown since 1987, but most of the change appears to have happened between 1987 and 2000, since the shares of employment have stayed relatively flat in the 2000s. Among RNF activities, shares of employment in services and business have increased, but other categories have remained relatively static.

Table 4.2 Share of Rural Nonfarm Workers Involved in Different Sectors, 2000–10

Sector	*Type of occupation (%)*	*2000*	*2005*	*2010*
Services	High-skilled (professional)	13.4	15.2	15.0
	Semiskilled (office-related jobs)	3.2	3.7	3.7
	Low-skilled (domestic and personal)	6.5	4.2	4.4
	Construction	4.1	4.9	6.5
	Transport	14.5	17.1	15.3
	Trade and sales	28.5	25.8	25.3
	Hospitality	2.1	2.6	1.6
Business and manufacturing	Handloom and tailoring	8.1	8.6	8.9
	Food processing	3.0	1.9	3.6
	Furniture makers	4.3	4.3	4.8
	Other manufacturing	7.4	5.8	6.6
	Others	4.8	5.8	4.5

Sources: HIES 2000, 2005, 2010.

Table 4.3 Distribution of Rural Workers by Type of Employment, 1987–2008
percent

	Primary occupation			
Category of employment	*1987*	*2000*	*2004*	*2008*
Agricultural, of which:	66.1	54.5	56.9	56.8
Farming	65.4	75.6	79.4	74.3
Agricultural wage-based	32.8	22.2	18.8	23.6
Livestock and fisheries	1.8	2.2	1.8	2.1
Nonagricultural, of which:	33.9	45.5	43.1	43.2
Services	45.7	38.2	47.6	44.7
Business	22.4	28.6	28.8	30.6
Shopkeeping	4.4	5.3	3.0	2.1
Mechanic	2.1	8.6	6.3	7.4
Rickshaw van and pulling	5.9	11.6	11.1	11.3
Other transport	3.8	2.6	2.8	3.7
Construction-based	10.0	4.0	0.8	0.3
Other nonagriculture-based	5.6	1.3	—	—
Total	*100.0*	*100.0*	*100.0*	*100.0*

Sources: MH panel surveys.
Note: — = not available.

An important dimension of employment patterns is their spatial evolution. Figure 4.5 shows the spatial pattern of change in the shares of different types of RNF employment between 2000 and 2013. The spatial disaggregation is based on the districts where the households live: adjacent to the two major cities of Dhaka and Chittagong; adjacent to well-connected secondary cities; adjacent to poorly connected secondary cities; and the rest of the country.

Figure 4.5 Change in Shares of Employment Type by Location, 2000–13

Sources: MH surveys.
Note: CHT = Chittagong; DHK = Dhaka.

Figure 4.5 clearly shows the importance of connectivity and operating environment, which appear to be higher around the secondary cities and to some extent in more rural areas (probably reflecting the good performance of agriculture, which generates employment through forward and backward linkages). The biggest change across the spatial categories occurred around Dhaka and Chittagong. Consistent with the general perception that these cities are becoming congested, a significantly larger share of the workforce is engaged in nonagricultural wage labor, a largely unskilled category of employment. Shares of employment in all other categories, including business, low- and high-skilled services, and the transport sector (including both rickshaw pullers and other transport activities) have declined. The areas with the largest increase in business activities over the 13-year period are those adjacent to well-connected secondary cities, which also show a slight improvement in low-skilled services.

The patterns observed in the panel data are consistent with those found in the World Bank (2004) report on the RNF sector in Bangladesh. Based on a 2003 survey of rural enterprises, the report shows that wholesale and retail trade have the largest share of RNF employment, with manufacturing (broadly defined) being the next largest.

Tables 4.2 and 4.3 and figure 4.5 are based on the employment status of individual workers, but another useful perspective on RNF activities comes from examining the types of establishments providing employment in the RNF sector—of interest to the rural manufacturing or industrial sector. The 2011 Survey of Cottage Industries by BBS provides data to profile the spectrum of rural establishments (BBS 2011). The largest share of cottage industry establishments, nearly 21 percent, is involved in processing or manufacturing food products (table 4.4).

Table 4.4 Distribution of Cottage Establishments by Industry Type Based on Two-Digit Bangladesh Standard Industrial Classification (BSIC)

BSIC no.	*Type of industry*	*Number*	*Percent*
10	Manufacturing of food products	171,344	20.6
13	Manufacturing of textiles	141,035	17.0
31	Manufacturing of furniture	103,637	12.5
16	Manufacturing of wood and products of wood	76,780	9.2
32	Other manufacturing	76,157	9.2
25	Manufacturing of fabricated metal	75,967	9.1
14	Manufacturing of wearing apparel	42,730	5.1
23	Manufacturing of nonmetallic products	27,038	3.3
—	All others	116,167	14.0
	Total	*830,855*	*100.0*

Source: BBS Cottage Industry Survey 2011.

Evolution of Rural Nonfarm Enterprises

Khandker and Samad (2014) use two data sources to better understand the nature and drivers of RNFEs—the HIES surveys of 2000, 2005, and 2010, and the unique WBI longitudinal panel surveys. As discussed in chapter 1, the two surveys use different sampling designs, each with its strengths and weaknesses. The full HIES sample is nationally representative but successive rounds are repeated as cross sections, not as panel surveys. The WBI surveys contain repeated observations of the same households over a long (20-year) period, providing insight into how households have evolved over time. A particular feature of the WBI panel surveys is that they started out with a focus on the client base of microfinance institutions, and as such the sample design has a particular focus on the poor and landless, the target group for the microfinance industry. A comparison of the HIES and WBI panel for the closest years (2000 for HIES and 1998–99 for WBI) shows that the WBI sample is closely matched with the bottom 60 percent of the households in terms of per capita incomes. In other words, although the WBI surveys are not nationally representative, they provide an aperture for understanding the bottom 60 percent of the rural population, a group of particular interest for poverty reduction.

Khandker and Samad (2014) compare the broad composition of RNF income for the two data sources (table 4.5). The comparison provides insight into the income profile of the lower income groups relative to the full population. The WBI sample shows a higher share of microenterprises, whereas HIES shows a higher share in wage and salaried incomes—a likely reflection of the WBI sample, with its focus on the microfinance target group. For the closest comparable years, the other sources of incomes are broadly similar. This comparison suggests that microenterprises are an important pathway out of poverty for the bottom 60 percent of households, most of whom are likely to be landless.

Khandker and Samad (2014) also compare the major types of activity for RNFEs across the two data sources (table 4.6). The HIES data indicate that

Table 4.5 Shares of Rural Nonfarm Incomes: Comparison of HIES and WBI Panel Surveys
percent

	2000	*2005*	*2010*
HIES	*(N = 2,758)*	*(N = 2,917)*	*(N = 3,459)*
Share of enterprise income	21.3	18.1	21.8
Share of wage and salaried income	27.8	30.7	36.1
Share of income from misc. sources	39.0	39.6	28.9
Share of remittance	11.9	11.6	13.2
	1991–92	*1998–99*	*2010–11*
WBI panel surveys	*(N = 1,509)*	*(N = 1,758)*	*(N = 2,322)*
Share of enterprise income	38.2	36.1	30.4
Share of wage and salaried income	44.5	25.2	24.1
Share of income from misc. sources[a]	12.9	28.5	30.4
Share of remittance	4.3	10.2	15.1

Sources: BBS, HIES 2000, 2005, 2010; Khandker and Samad 2014; WB-BIDS surveys 1991–92 and 1998–99; WB-InM survey 2010–11.
a. Receipt of self-employed professional (lawyers, doctors, tutors, etc.), rental income from properties and assets, interests and profits from savings and investments, and receipts from safety net programs, charities, etc.

Table 4.6 Distribution of Rural Nonfarm Enterprises by Activity Type: Comparison of HIES and WBI Panel Surveys
percent

	2000	*2005*	*2010*
HIES	*(N = 1,427)*	*(N = 1,426)*	*(N = 1,909)*
Manufacturing and processing	11.9	10.3	13.9
Transport	9.3	6.3	13.1
Trade	2.4	2.5	2.3
Service	65.3	75.8	61.5
Other miscellaneous activities	11.1	5.1	9.2
	1991–92	*1998–99*	*2010–11*
WBI panel surveys	*(N = 775)*	*(N = 1,031)*	*(N = 1,089)*
Manufacturing and processing	19.7	12.0	7.9
Transport	14.2	30.0	32.7
Agricultural trading	19.0	14.0	16.7
Nonagricultural trading	38.9	39.6	38.2
Services	8.2	4.4	4.5

Sources: BBS, HIES 2000, 2005, 2010; Khandker and Samad 2014; WB-BIDS surveys 1991–92, 1998–99; WB-InM survey 2010–11.
Note: Manufacturing and processing include manufacturing and processing in food and beverages, tobacco, textiles, wood and furniture, rubber and plastic, basic metal, and nonmetal products. Transport includes operation and rental of various transport vehicles. Trade includes wholesale and retail trading of various farm and nonfarm products such as livestock, poultry, vegetables, fruits, rice, furniture, utensils, shoes, clothing, operating stores, shops, and so on. Service includes skill-based or specialized activities such as those of carpenters, masons, blacksmiths, electricians, barbers, tailors, real estate agents, social workers, counseling, banking, doctors, restaurant and hotel business, and so on, and the miscellaneous sector includes other small activities.

Table 4.7 Characteristics of Rural Nonfarm Enterprises, 2000–10

	2000	*2005*	*2010*
Enterprise characteristic	*(N = 1,427)*	*(N = 1,426)*	*(N = 1,909)*
Years in business	7.2	9.2	10.0
		($t = -1.33$)	($t = -2.12$)
Share of registered enterprises (%)	9.9	14.7	18.2
		($t = -3.85$)	($t = -2.61$)
Share of home-based enterprises (%)	11.9	14.2	16.7
		($t = -1.80$)	($t = -1.94$)
Months operating per year	10.3	10.7	10.9
		($t = -3.79$)	($t = -3.00$)
Number of workers	1.6	1.7	1.4
		($t = -0.75$)	($t = 2.52$)
Share of hired labor in total workforce (%)	11.0	10.0	8.7
		($t = 0.88$)	($t = 1.69$)
Owner's sex (% male)	96.4	94.8	95.5
Owner's age (years)	44.5	46.1	46.7
Owner's education (years)	3.2	3.5	3.5

Sources: BBS HIES 2000, 2005, 2010.
Note: Owner's characteristics are that of the head of the household that owns the enterprise. Figures in parentheses are *t*-statistics of the differences with the value from the previous year.

services dominate RNFEs, whereas the WBI data indicate that RNFEs operated by the poor are concentrated more in trading and transport.

Probing further, table 4.7 presents some of the key features of RNFEs between 2000 and 2010, based on the HIES data. Over that decade, a significantly higher share of RNFEs were registered enterprises (in other words, they had formalized their operations), and they tended to become relatively more home-based. Interestingly, the age of the average enterprise rose, signaling a higher rate of survival. Other characteristics did not alter much, however. Most RNFEs remained small, male-dominated, and family-operated businesses. Most operated year round.

Based on data from the WBI panel surveys, table 4.8 looks at transitions in the activities of RNFEs operated by households between 1998–99 and 2010–11. Households showed considerable movement into and out of RNFEs of all types, but only one-quarter of households changed the type of RNFE they operated. About one-third to one-half of RNFEs went out of business over the 12-year period. About one-third of the RNFEs dedicated to manufacturing and trading in 1998–99 survived over time, and close to half of those in transport managed to stay in business. The highest mobility is seen in the services sector, where half of all RNFEs went out of business, and another 26 percent entered trading or another of the remaining activities. The activities of some RNFEs (such as services) seem to be temporary, with a high proportion either quitting nonfarm activity altogether or moving to another nonfarm activity, whereas others (transportation is one example) endured for the entire period.

Table 4.8 Transitions in Activities of Rural Nonfarm Enterprises Operated by Households, 1998–99 to 2010–11
percent

	2010–11 activity (row percentage)					
1998–99 activity (% of households in 1998–99)	*No RNFE activity*	*Manufacturing and processing*	*Transport*	*Agriculture-based trading*	*Non-agricultural trading*	*Services*
No RNFE activity (51.6)	73.7	2.0	7.7	4.5	10.8	1.3
Manuf. and processing (6.2)	40.2	33.3	7.0	2.6	14.5	2.4
Transport (14.1)	35.2	1.1	53.3	2.7	7.4	0.3
Agriculture-based trading (6.8)	39.3	2.3	10.7	32.2	15.4	0.1
Nonagricultural trading (19.3)	39.9	3.8	9.9	7.5	35.6	3.3
Services (2.0)	49.1	4.4	8.6	8.8	25.7	3.4

Sources: WB-BIDS survey 1998–99; WB-InM survey 2010–11.
Note: RNFE = rural nonfarm enterprise.

Drivers of Nonfarm Growth

Farm and Rural Nonfarm Linkages

Agriculture's forward and backward linkages have long been recognized as dominant sources of nonfarm jobs. A large body of literature is concerned with the basic linkages connecting agriculture with nonfarm (and overall economic) growth; the main conclusions are summarized in annex 4A. Some of the jobs are "pull" jobs—created to supply inputs for agricultural production or for processing primary products. In contrast, "push" jobs are generally those that small farmers or the landless are forced into out of necessity. Farming characteristics in different contexts create these "pull" and "push" scenarios.

In Bangladesh, estimates of the linkages of various RNF activities to agriculture vary but are in line with the broader development literature on the subject. The main conclusion is that agriculture remains a major driver of RNF growth. Hossain (2004) finds that more than 50 percent of rural households' activities are directly linked to agriculture. Following the insights of Mandal (2003)—taking account of the backward and forward linkages—Sarker, Mandal, and Kleinke (2013) empirically estimate that every 100 person-days of farm employment in rice production generates an additional 58 person-days of employment in the nonfarm economy through a multitude of support services, processing, and marketing activities.

Sectoral multipliers are a summary measure of these intersectoral linkages. Starting with Lewis (1954) and Johnston and Mellor (1961), numerous studies across a range of countries and contexts have confirmed that agricultural multipliers are greater than 1. The general consensus is that the multipliers are between 1.5 and 2. For Bangladesh, a World Bank study in 2008 provided similar estimates of multiplier effects of various tradable goods in agriculture (World Bank 2008). The results show the effects of a 1-taka (BDT) exogenous increase in value added from the various tradable goods sectors.

Table 4.9 Multiplier Effects of Various Economic Sectors, 2008

	Effects of a BDT 1 increase in value added of respective sectors					
			Change in household income			
Sector	*Value added multipliers*	*Change in valued added*	*All HHs*	*Agricultural HHs*	*Rural nonfarm HHs*	*Urban HHs*
Paddy	0.96	1.96	1.42	0.74	0.32	0.37
Grains	0.56	1.56	1.24	0.63	0.27	0.34
Livestock	0.96	1.96	1.55	0.91	0.35	0.28
Shrimp	0.82	1.82	1.09	0.60	0.24	0.25
Food industry	1.43	2.43	2.23	0.94	0.52	0.77
Ready-made garments	0.85	1.85	1.07	0.33	0.27	0.47
Knitwear	0.44	1.44	0.38	0.12	0.09	0.17
Other industry	0.74	1.74	1.17	0.39	0.28	0.50
Utilities	0.55	1.55	0.66	0.18	0.15	0.33

Source: World Bank 2008.
Note: BDT = Bangladesh taka; HH = household.

On average, an increase of BDT 1 in the output of tradable goods in Bangladesh leads to a further BDT 1.07 increase in value added from nontraded goods and services (table 4.9). This gain occurs mainly because of consumer spending effects since incomes earned in various activities are spent in the domestic economy.

Multipliers are smallest in sectors with few production linkages (such as knitwear, for which most inputs are imported and most outputs are exported). The multiplier for the food industry is especially large because of major backward production linkages to the nontradable crops sector (pulses, fruits, vegetables, and so forth).

Table 4.9 also shows gains in household income arising from increases in the output of various sectors and the accompanying multiplier effects. Not surprisingly, agricultural households (including agricultural laborers) reap most of the benefits of agriculturally led growth. They also benefit from industrial growth, though to a lesser degree, since they gain almost exclusively from the multiplier effects alone and not from the direct effects of increases in industrial output and employment. The exception is the food industry. Although an increase in food industry output has only limited direct effects on agricultural household incomes, it has very large indirect effects on nontradable agriculture, so that a BDT 1 increase in value added of the food industry results in a gain of BDT 0.94 in agricultural household incomes.

The effect of agricultural growth (evident from the multipliers) on the nonfarm sector is attained through diversification and structural transformation. Timmer (2005) calls it a "successful transition" from rural food security (primarily subsistence) to a higher level of rural productivity through diversification and commercialization. The rural economy in Bangladesh already shows signs of that transition. The challenge is to encourage this transition to move more rapidly than it has to date.[5]

More recent evidence on the continuing strong farm-nonfarm linkages for Bangladesh comes from Khandker and Samad (2014) and Shilpi and Emran (2015) (as discussed in chapter 2). Using HIES and WBI data, Khandker and Samad estimate that a 10 percent increase in farm income growth leads to additional growth in nonfarm income of 6 percent. Some of these linkages are empirically verified by Shilpi and Emran (2015), who estimate a significant positive impact of agricultural productivity on the growth of informal manufacturing and skills services employment. Another insightful paper by Emran and Shilpi (2014) shows the significant impact of agricultural productivity on agricultural wages, the supply of off-farm labor, and per capita household expenditure. Emran and Shilpi find that a 1 percent increase in crop yields leads to a 1 percent increase in wage rates. These effects are strong and positive with respect to welfare and poverty reduction. Agriculture's role as an important driver of nonfarm incomes remains empirically robust.

Changes in the Characteristics of Rural Nonfarm Enterprises

A defining feature of rural economic transformation is the rural population's transition from a dependence on agriculture to an increasing involvement in nonagricultural activities. The WBI data show the extent to which RNFEs are moving away from agriculture (table 4.10). Over the 12-year period, a surprising share of households moved out of RNFEs—a movement consistent with the employment trends discussed earlier. Among households remaining in RNFEs, the share of RNFEs with direct linkages to agriculture (for example, engaged in milling, processing, trading, and agricultural equipment and repair services) declined from 27 percent to 15 percent.

Households involved in RNFEs may not depend directly on the farm sector—they trade in nonagricultural goods, engage in transport and craftwork, make furniture, provide services, and so on—and strictly speaking may not depend on farm production per se. Yet the fortunes of the farm sector still affect these enterprises, insofar as farm incomes drive demand for the products and services of RNFEs (through linkage effects). In this sense, many households involved with RNFEs remain subject to the same volatility and seasonality that typify the farm sector.

Table 4.10 Distribution of Rural Nonfarm Enterprises Based on Their Linkages to the Farm Sector, 1998–99 and 2010–11
percent

Activities	*1998–99*	*2010–11*
RNFE activities linked to the farm sector	26.5	14.8
RNFE activities not linked to the farm sector	20.2	27.0
Households with no RNFE activities	53.2	58.2
Total (N)	*2,558*	*3,264*

Sources: WB-BIDS surveys 1998–99; WB-InM survey 2010–11.
Note: RNFE = rural nonfarm enterprise.

Sophistication of Rural Nonfarm Enterprises

RNFEs can also be assessed by looking at how the complexity, sophistication, and scale of their activities have changed over time. For example, making *gur* (molasses or brown sugar) is a basic activity, whereas operating a bakery is a more advanced activity; making cane or bamboo products is a basic activity, whereas making furniture is advanced; repairing a bicycle or rickshaw is a basic activity, whereas repairing automobiles is advanced. Broadly characterizing the activities of RNFEs in this manner, Khandker and Samad (2014) look at the share of RNFEs engaged in basic and advanced activities in 1998–99 and 2010–11. Basic activities predominate (occupying 28.8 percent and 24.7 percent of the sample in 1998–99 and 2010–11, respectively) (table 4.11). The extent of basic activities has dropped a bit over time, but the extent of advanced activities did not increase, remaining at about 17 percent or 18 percent.

The transition from basic to advanced nonfarm activities over time is a key component of growth in the nonfarm sector. Table 4.12 shows that only 15 percent of households involved in basic RNFE activities in 1998–99 switched to more advanced activities by 2010–11, while about 38 percent left RNFE activities. Among those involved in advanced activities in 1998–99, only about 37 percent remained in 2010–11, while 22 percent had returned to basic activities. Among households that did not engage in any RNFE activities in 1998–99, only about 11 percent moved on to advanced activities by 2010–11, while 15 percent moved on to basic activities.

Table 4.11 Progression in the Sophistication of Rural Nonfarm Enterprises, 1998–99 and 2010–11
percent

Activities	*1998–99*	*2010–11*
Basic RNFE activities (%)	28.8	24.7
Advanced RNFE activities (%)	17.9	17.1
Households with no RNFE activities (%)	53.3	58.2
Total (N)	*2,558*	*3,264*

Sources: WB-BIDS surveys 1998–99; WB-InM survey 2010–11.
Note: RNFE = rural nonfarm enterprise.

Table 4.12 Transition from Basic to Advanced Activities in Rural Nonfarm Enterprises, 1998–99 and 2010–11
percent

	2010–11 activities		
1998–99 activities	*Basic RNFE activities*	*Advanced RNFE activities*	*Households with no RNFE activities*
Basic RNFE activities	47.3	15.0	37.7
Advanced RNFE activities	22.4	36.8	40.8
Households with no RNFE activities	15.0	11.2	73.8

Sources: WB-BIDS surveys 1998–99; WB-InM survey 2010–11.
Note: RNFE = rural nonfarm enterprise.

The picture that emerges is one of a stagnant RNFE sector in which the progression from basic to more advanced activities has not been as great as might be desired. It may be that demand for more advanced activities is limited but will increasingly emerge with sustained growth in rural incomes. For example, a switch from rickshaw or bicycle repair to automobile repair cannot occur steadily without a growing number of automobiles in rural areas.

Returns to Rural Nonfarm Enterprises

Another factor at play could be that the rates of return are not sufficient to induce households to switch from basic to more advanced RNFE activities, but that hypothesis seems unlikely; entrepreneurs who switched from basic to advanced RNFEs earned significantly higher rates of return. Estimates from HIES data for 2010 show consistently high rates of return of about 50 percent across all RNFE categories (manufacturing and processing, transport, agricultural trading, nonagricultural trading, and services), with the highest rates reported for transport enterprises (68 percent), likely reflecting payoffs to the government's significant investment in roads.[6] In actuality, households that switched from basic to advanced activities or remained engaged in advanced activities over time enjoyed much higher returns than their counterparts engaged in basic activities, and the difference between returns to basic and advanced activities is statistically significant (table 4.13).

These findings unequivocally show that moving from basic to more advanced activities is literally rewarding for rural entrepreneurs. What is not clear is why the transition to more sophisticated rural enterprises has stalled. The lack of growth in RNFEs (in fact, the decline in participation over time) is all the more puzzling because households that are not engaged in RNFEs have significantly lower incomes per capita (table 4.14). Becoming involved in an RNFE, or remaining in RNFE activities, would appear to be a better choice as far as income is concerned.

A statistical analysis by Khandker and Samad (2014) confirms the results of the rate of return analysis reported here. Khandker and Samad estimate production and profit functions using HIES and WBI panel data. They find the marginal returns to capital to be positive and significant—as well as significant in

Table 4.13 Rates of Return to Rural Nonfarm Enterprises by Level of Sophistication, 1998–99 and 2010–11
percent

	2010–11 activities		
1998–99 activities	*Basic RNFE activities*	*Advanced RNFE activities*	t-*statistics of the difference*
Basic RNFE activities	36.6	70.4	7.06
Advanced RNFE activities	60.6	83.4	4.31

Sources: WB-BIDS surveys 1998–99; WB-InM survey 2010–11.
Note: RNFE = rural nonfarm enterprise.

Table 4.14 Household Income Based on the Transition from and to Rural Nonfarm Enterprises, 1998–99 and 2010–11
BDT per capita per month

	2010–11 activities		
1998–99 activities	*Households engaged in RNFE activities*	*Households not engaged in RNFE activities*	t-*statistics of the difference*
Households engaged in RNFE activities	1,681.9	628.5	9.02
Households not engaged in RNFE activities	2,347.8	706.8	10.90

Sources: WB-BIDS surveys 1998–99; WB-InM survey 2010–11.
Note: BDT = Bangladesh taka; RNFE = rural nonfarm enterprise.

magnitude (with an estimated elasticity of 0.35 for HIES and 0.26 for WBI). The WBI results (which, as noted, are more pertinent to lower-income households) suggest potential capital constraints, with RNFE output being more sensitive to nonlabor inputs than to labor inputs. These results are consistent with the surplus labor and insufficient access to capital that are generally presumed to prevail among poorer (and mostly landless) households.

Urban Proximity

Traditional patterns of RNFE development show that RNFEs are particularly apt to thrive in proximity to dynamic urban settings. Some scholars view this pattern as evidence of the RNF sector's key role as a bridge between commodity-based agriculture and livelihoods earned in the modern industrial and services sector in urban centers. Throughout Asia, the nonfarm sector has been the ladder from underemployment at farm tasks to regular wage employment in the local economy, and from there to jobs in the formal sector (Wiggins and Hazell 2008).

Although it can generally be assumed that with robust agricultural growth RNFEs will typically enjoy rapid growth, it is not a certainty that all nonfarm activities will flourish. Members of farm households initially undertake some nonfarm activities as part-time occupations, which may eventually grow into separate, full-time commercial activities. Some nonfarm activities such as pottery making, basketmaking, and household poultry production die out over time, displaced by cheaper, more regular, and, at times, better quality supplies from the commercialized and modern sectors. Case studies of pottery and household weaving clearly show that these cottage-based industries are declining, primarily because substitutes are available (box 4.1).

The demise of low-productivity, household-based manufacturing enterprises explains, in part, why employment in services and commerce frequently grows faster than employment in manufacturing. Changes in consumer spending likewise contribute to faster growth in services and commerce. Consumption data show that as incomes rise, rural households increase spending on services such as education, health, transport, and prepared food more rapidly than they increase spending on any locally manufactured goods.

Box 4.1 Case Studies of Selected Cottage Industries in Bangladesh

Pottery making in Natore in northern Bangladesh is a truly traditional, family-based artisanal industry involving both male and female family members, but it is on the verge of disappearing. Pottery (earthenware, stoneware, and porcelain) is one of the oldest and most widespread of the decorative arts, in which functional objects (vessels, vases, plates, and bowls of different colors, for instance) are made from clay hardened with heat at a high temperature. The industry is declining for several reasons, including falling demand, increasing clay costs, and the lack of capital and appropriate technical support for product diversification. Pottery makers are unable to compete with aluminum and other cheaper modern materials and are forced to seek alternative employment. Demand seems to have been sustained for a few pottery products, such as flower tubs and disposable food containers, but pottery makers often cannot muster the capital or acquire the know-how to meet the demand for those differentiated or specialized products.

Serious challenges have also emerged in the cottage-based handloom industry for making *lungis*. Known as sarongs in many countries, these traditional garments are worn around the waist by men in Bangladesh. Originally made on handlooms, lungis are now manufactured mostly in cottage industries employing power looms. Erratic power supply forces power loom owners to rely on generators during about 70 percent of the production time, but the high cost of electricity produced with a generator (more than double the cost of electricity from the grid) makes the industry uncompetitive. Lack of working capital is another major issue. Periods of high demand create a shortage of thread and the price rises. Buying thread in bulk and stocking it for peak demand periods requires access to large amounts of working capital, which most weavers find difficult to raise. Lungi weavers report paying up to 18 percent interest per annum for loans. Microfinance is not a solution for most financing needs because the weekly or monthly repayment schedules do not fit the seasonal cash-flow needs of the lungi business.

Light engineering (the building of small machinery and equipment) is a successful and expanding cottage industry that is evolving to play a significant role in the rural economy. Frequently referred to as a "mother industry," it supports other industries by providing capital machinery, spare parts, and maintenance support, and it offers many opportunities to add value, contribute to economic growth, and reduce poverty. The heart of the country's foundry industry is in Bogra, where more than 70 percent of the foundries are situated and supply around 80 percent of the agricultural equipment nationwide—especially centrifugal pumps for irrigation. These factories manufacture all kinds of spare parts for power tillers and agricultural machinery, in addition to a diverse assortment of other products—tubewells, lathes, sawmills, flour mills, slip and brake drums for motor vehicles, machinery for textile and jute mills, grinding machinery, and parts for ships. Rapid growth in demand from agricultural producers has been a key driver, demonstrating the crucial role of market demand in the start and growth of rural industry.

Source: Hussain 2015.

As argued by most, and empirically established by some, another key driver of the RNF sector is the demand for products, which is facilitated by better access to urban centers. While investment in nonfarm activities is often financed by the surplus generated by productivity increases in agriculture, the location of RNF activities is more likely determined by the market size, which in turn is a function of the degree to which the producer needs to be close to customers and the scale of production. Guided by these considerations, productive nonfarm activities and services may locate in villages, small towns, or cities. Towns provide consumer demand and purchasing power for higher-value agricultural products (such as horticultural crops), thus encouraging diversification. They provide complementary services to farm producers, value-added services such as food processing, trading, exporting, technical know-how, ideas for new products, and financing, and sometimes they create manufacturing jobs for surplus labor.

Using the distance to district headquarters from the *upazila* (subdistrict) to measure proximity, Khandker and Samad (2014) examine how RNFE productivity changes with proximity to growth centers. An activity is considered to be close to a growth center if the upazila is within 5 kilometers of the district headquarters, and away from a growth center if the upazila is beyond 5 kilometers from the district headquarters. Table 4.15 shows how the productivity of RNFE activities varies by distance to growth centers. Overall, activities close to growth centers appear to be more productive than those farther away, although the difference is statistically significant only in 1998–99. As per the 1998–99 data, RNFE activities close to growth centers have a 45.8 percent rate of return, while those away from growth centers have a 39.3 percent rate of return. This result is expected, as activities closer to growth centers are likely to have better access to inputs and better markets for their products than those farther away.

Given that most studies show that the RNF sector benefits immensely from proximity to urban centers, broad-based urban growth, in which no rural producer is far from an urban center or hub, should be more conducive to growth of the RNF sector over a wider rural space than when urban growth is concentrated in only a few megacities. Dhaka, the capital and megacity, is the most rapidly growing urban area in Bangladesh, followed by Chittagong (a port city).

Table 4.15 Rates of Return to Rural Nonfarm Enterprises Based on Proximity to Growth Centers, 1991–2011
percent

	RNFE activities close to urban areas	*RNFE activities away from urban areas*	t-*statistics of the difference*
1991–92 (*N* = 775)	41.8	41.7	0.03
1998–99 (*N* = 987)	45.8	39.3	1.91
2010–11 (*N* = 1,081)	57.0	56.6	0.09

Sources: WB-BIDS surveys 1991–92 and 1998–99; WB-InM survey 2010–11.
Note: An activity is considered close to urban areas if the upazila is within 5 km of the district headquarters and is considered to be away from urban areas otherwise. RNFE = rural nonfarm enterprise.

All other urban centers have grown much more slowly, with the result that growth of the RNF sector is concentrated around the two major cities and on the corridor that connects them. A deliberate policy to foster more broad-based urban growth by developing the road and rail network is desirable not only to relieve congestion in the major cities but also to boost nonfarm growth.

Promoting Rural Nonfarm Activities: Opportunities and Constraints

By nature, RNF activities are largely private sector activities, yet the public sector can and does play an important role in promoting robust growth of the RNF sector. The roles that the public sector is playing well and those that require additional attention can be identified based on a clear understanding of the main drivers of RNF activities and the constraints operating in the RNF sector. Three sources of data at the household level are particularly useful for providing the granular detail required for an effective analysis of those drivers and constraints—the HIES, the WBI longitudinal panel, and the MH panel surveys (although these sources have some limitations, as discussed).

Self-Reported Constraints

Consistent with results from the analysis of the determinants of productivity and profits in RNFEs, Khandker and Samad (2014) analyze information from HIES on self-reported constraints by households with RNFEs.[7] Operators of rural enterprises report pervasive constraints (table 4.16), although the percentage of operators experiencing constraints declined from 67 percent in 2000 to 50 percent in 2010. In all three HIES surveys, households reported a larger share of noncredit constraints than credit constraints, but credit remains the single biggest

Table 4.16 Self-Reported Constraints Faced by Households that Operate Enterprises, 2000–10
percent of households with enterprises

	2000	*2005*	*2010*
Constraint	*(N = 1,427)*	*(N = 1,426)*	*(N = 1,909)*
No constraints	33.0	23.8	49.8
Inadequate capital or credit	27.1	25.5	22.1
Inadequate know-how	3.8	3.9	2.2
High operating cost	0.1	0.0	3.6
Unreliable or inadequate power and water supply	1.2	1.4	3.7
Problems with equipment or spare parts	1.7	0.6	0.4
Government regulations	2.5	4.0	1.1
Lack of raw materials	10.5	18.1	2.8
Inadequate demand for products	8.3	6.2	7.1
Transport problems	2.5	7.1	5.0
Other miscellaneous problems	9.3	9.4	2.2

Sources: BBS, HIES 2000, 2005, 2010.
Note: Enterprises may face multiple constraints, but they were asked to report the most severe constraint.

constraint reported. Progress on noncredit constraints has also been better: the percentage of households reporting noncredit constraints fell from 40 percent to 28 percent, while the decline in the share of households with credit constraints was relatively smaller. Among the various noncredit constraints reported in 2010, problems related to market access (demand), transport, and utilities (power and water) are the most common.

Khandker and Samad (2014) also report that in 2010, operators of enterprises in the services sector were most constrained (57 percent reported any type of constraint), followed by operators of enterprises engaged in miscellaneous activities (49 percent), manufacturing (44 percent), and trade and transport (some 30 percent each). Enterprises in the services sector also experienced the most credit constraints, followed by miscellaneous activities, manufacturing, trading, and transport.

The WBI panel survey shows a significantly different picture. As noted, the WBI survey is targeted to low-income households, the target group for microfinance. A negligible share of households (1 percent) participating in the 2010–11 WBI survey reported credit constraints,[8] a decline from about 8 percent in the 1998–99 survey. This difference could reflect two factors at play: (a) households may not require capital, since not all households need or want to borrow on credit, and (b) the needs of those that do want credit are met by available sources. The reported credit constraints are consistent with the households' reported sources of finance for start-up capital (table 4.17).

Table 4.17 Sources of Start-Up Capital for Rural Nonfarm Enterprises
percent

HIES data			
	2000	*2005*	*2010*
Share of different sources	*(N = 1,427)*	*(N = 1,426)*	*(N = 1,909)*
Own resource (asset, inheritance, savings, etc.)	78.3	78.7	79.9
Loans from microcredit	3.3	5.8	8.2
Loans from commercial banks	0.8	0.6	1.0
Loans from informal moneylenders	2.4	0.7	1.1
Loans from relatives or friends	5.5	4.0	5.6
Others	9.7	10.2	4.2
WBI panel data			
	1991–92	*1998–99*	*2010–11*
Share of different sources	*(N = 775)*	*(N = 1,031)*	*(N = 1,089)*
Own resource (assets, inheritance, savings, etc.)	64.0	50.6	55.7
Loans from microcredit	8.5	21.6	26.1
Loans from commercial banks	1.3	0.3	0.4
Loans from informal moneylenders	13.6	8.6	5.0
Loans from relatives or friends	6.1	8.0	8.0
Others	6.5	10.9	4.8

Sources: BBS, HIES 2000, 2005, 2010; WB-BIDS surveys 1991–92, 1998–99; WB-InM survey 2010–11.

HIES data show that the vast majority (four out of every five) of current RNFEs rely on their own sources of capital to start a business; the share of households relying on their own sources is lower in the WBI surveys. Both the HIES and WBI datasets show that the trend in borrowing from microcredit institutions is rising, indicating their growing importance. The share is understandably higher in the WBI survey, since the sample is more focused on the microfinance client base.

Impact and Determinants of Credit and Other Constraints

Further analysis by Khandker and Samad (2014) on the likely impact of credit and noncredit constraints sheds much light on their detrimental impact on profit margins (detailed results are in annex 4A, table 4A.2, for the HIES sample, and table 4A.3 for the WBI panel households). Constrained enterprises in the HIES sample earn profits that are about 9 percent lower than profits obtained by their unconstrained counterparts. For the WBI sample, credit constraints have a much larger impact—they reduce profits by 28 percent.

Enterprises that are less likely to be credit constrained tend to be formally registered, operated by more educated and wealthier households (with larger assets), larger (in terms of number of employees), and household-based (annex 4A, table 4A.4). Enterprises in villages with electricity are also less likely to be credit constrained, while enterprises in villages with more irrigated area and enterprises that have been in business for some time are more likely to be credit constrained—perhaps reflecting constraints to expansion or reflecting the level of competition (since older enterprises and those in more productive areas might face more competition).

Although enterprises operating in the transport and services sectors are less likely to be credit constrained, those in manufacturing are more likely to be constrained. Interestingly, the determinants of noncredit constraints for several correlates are the opposite in sign than for credit constraints—a larger asset base, large number of employees, and higher share of hired labor in the workforce all raise the likelihood of noncredit constraints, while the years of operation tend to reduce noncredit constraints. The data seem to suggest that it may be much easier to initiate an enterprise than to expand it once it has become established.

These findings are consistent with the broader findings on the investment climate for private sector–led growth in Bangladesh discussed in depth in World Bank (2015a). Briefly, after the initial phase of reforms that unleashed significant private-sector activity since the early 1990s, Bangladesh now requires a more complicated set of reforms for improving investment incentives and efficiency. The Doing Business Indicators remain low (World Bank 2015b). The topmost concern of businesses is political instability (domestic disruptions, such as *hartals*, or strikes), which hits agricultural value chains particularly hard given the perishable nature of most agricultural commodities. Unreliable electricity, insufficient access to finance, and corruption are the next three top constraints faced by businesses. Beyond these binding constraints, excessive regulations and institutional

weaknesses (obsolete and complex rules, laws, and regulations), tax complexities, and poor contract enforcement are major hindrances to investment and to the operation of profitable businesses.

Conclusions and Implications

The RNF sector is a major source of productive employment and income in Bangladesh, providing some income to over three-quarters of rural households. While agriculture remains the main driver of rural growth, a majority of households rely on both sources of income for stability and growth, since the contribution of each source varies over time depending on the prevailing circumstances and performance of both sectors. Looking forward, the limited scope for expanding productive land, an increasingly educated and growing labor force, and increasing demand for nonfarm goods and services in Bangladesh make it imperative to develop a stronger and more vibrant RNF sector.

To understand the RNF sector and what it does, a useful characterization of RNF activities is provided by Hossain (2004), based on the asset-intensity of employment: manual labor, human capital, and physical capital. Evolving RNF patterns show an increasing concentration in labor, or manual employment, but declines in the share of business (physical capital) and skilled services (human capital) employment. Employment also has distinct spatial patterns. The megacities of Dhaka and Chittagong are seeing a significant rise in the share of RNF labor (or unskilled workers), but shares of all other categories of employment are falling, with the largest decline in business activity. Connectivity again plays a large role in the type of employment available around secondary cities. The spatial evolution of jobs shows that well-connected cities saw a rise in the share of business activities and some low-skilled services, while poorly connected cities saw a decline in business and high-skilled employment.

Forward and backward linkages of agriculture remain important in creating nonfarm jobs and driving RNF growth. The quality of the jobs that are created is also important. So-called "pull" jobs are created through market linkages for supplying inputs or processing outputs, whereas "push" jobs are those into which small farmers or the landless are pushed for survival.

It is in this context that the development of RNFEs and high-skilled services within the RNF sector is of particular interest. High-skilled services are heavily dependent on human capital and bring the roles of education and connectivity to the fore. RNFEs are a more challenging option in some respects, but they are also a more promising option in terms of alternative livelihoods for the current generation, as well as for future educated entrepreneurs. Analysis of RNFEs shows that more of them are being formalized (registered), but the majority remain small, male-dominated, and home-based businesses. Firms are constantly opening and closing, and a substantial number exit the RNF sector altogether. In terms of economic transformation, RNFEs have made some progress in reducing their dependence on agriculture (and its volatility). Panel data show that the households with enterprises show limited change in their sectoral (farm-based or nonfarm-based) orientation.

Another way to assess progression of RNFEs is to consider their complexity, sophistication, and scale of activities. The striking finding is that the progression is limited, with the majority of households engaged in RNFE activities remaining involved in basic activities. In fact, although the extent of basic activities has dropped a bit over time, the gap has not been filled by an increase in advanced activities. Another possibility is that while the share of households engaged in RNFEs may not be rising, existing enterprises may be growing and transforming over time. An analysis (using panel data) of RNFEs that have remained in business over time shows that a very low share (15 percent) of the households involved in basic RNFE activities in 1998–99 had switched to more advanced activities by 2010–11. The overall progression over time from basic activities toward more advanced activities within surviving RNFEs was not so great as to indicate broad-based growth in rural economic activities.

The less-rapid-than-expected emergence of RNFEs and their relatively limited transition to more sophisticated operations is puzzling, considering their positive and significant association with higher incomes. Households engaged in RNFEs have higher per capita returns, consistent with the positive and relatively higher impacts of both RNFEs and RNF capital on household income. Importantly, rates of return on advanced RNFEs are almost double those of basic RNFEs, and households that exited RNFEs did not enjoy higher incomes (per capita). The growth of RNFEs, both horizontally as well as vertically, thus appears to be constrained by factors other than profitability.

One factor that has traditionally been considered important in RNF activities is proximity to urban centers, especially dynamic urban settings. An important finding is that overall, the rate of return for RNFEs close to urban centers (major cities and secondary cities) is not statistically different from the rate of return for RNFEs farther from urban centers (using district headquarters as the point of reference). Perhaps better connectivity makes it less advantageous to be closer to urban centers. Another consideration is that most basic RNFEs produce traditional and low-quality products, which are being rapidly replaced by cheaper and better mass-produced products. While it is generally true that robust agricultural growth will promote rapid growth in the RNF sector, it is important to recognize that not all nonfarm activities may flourish. Some activities, such as pottery, basket-making, rice roller mills, or backyard poultry will increasingly be displaced by supplies from more modern industries, often from around urban centers.

Beyond considerations related to geographical location and connectivity (market size considerations), analysis of the major constraints faced by households points to two major constraints: lack of credit and poor infrastructure. The constraint reported most often by owners of RNFEs is limited access to credit, leading an overwhelming majority (80 percent) to finance their operations out of their own resources. Own resources will clearly be a constraint on the scale and scope of RNFEs, since the internal savings and investment process will in most cases take a very long time. An important lesson on this front comes from the microfinance industry, whose clients are much less dependent on their own resources, and who show significantly higher participation in RNFEs—and RNF

activities more broadly—with a concentration in high-turnover activities like trading and transport. The analysis of the correlates of constraints faced by households operating RNFEs shows that, not surprisingly, the more educated, wealthier, and household-based enterprises are less constrained by poor access to credit. Registered RNFEs and those with access to electricity are also less likely to be credit constrained. Among sectors, manufacturing RNFEs face more credit constraints than RNFEs focusing on services and transport. Interestingly, the several correlates of being noncredit constrained are the opposite of the correlates of being credit constrained: larger enterprises (in terms of assets or employees) and those using more hired labor face more noncredit constraints, indicating the presence of issues related to the broader enabling environment.

The main implications emerging from the analysis:

- There is a need to promote a better enabling environment, especially for emerging rural entrepreneurs, by facilitating better access to technology, information, capital, and infrastructure, and by removing the remaining business environment barriers, such as those influencing terms of trade, discriminatory taxes, and stifling regulations. In this connection, the recommendations of the 2004 World Bank report *Promoting the Rural Nonfarm Sector in Bangladesh* remain highly relevant: (a) invest in appropriate technology to improve the competitiveness of horticulture and livestock products; (b) put in an effective and trusted system of food quality and safety assurance; (c) promote a modern marketing system for handling, processing, transporting, and storing perishable products; and (d) remove the remaining tax and tariff anomalies.
- RNF activity is essentially private sector activity, but certain proactive engagements can serve important public goods functions, especially for prospective female and poor household entrepreneurs in areas in the initial stages of development. Examples include (a) making information available on the demand for nonfarm products and (b) providing assistance for skills training through mechanisms that allow prospective female entrepreneurs and weaker and less educated households to participate.
- A long-recognized constraint, also emphasized in the 2004 World Bank report and confirmed through more rigorous analysis, is access to finance. Improving access to credit and financial services for SMEs remains crucial for promoting more rapid and robust growth of RNFEs.
- The lack of a dependable power supply is another major constraint (and a more generic development constraint). Insufficient access to power, with frequent disruption of supply, causes productivity to be lost, reduces the viability of enterprises, and is a major factor inhibiting new entrants in the RNF sector.
- Finally, a rapidly growing share of RNFEs focuses on trading, especially in agricultural produce. Such activities may be discouraged by the lack of marketing facilities or constraining market inefficiencies. Addressing the underlying issues will help expand the scale of such RNF activities. The next chapter addresses these and other major issues relating to agricultural value chains.

Annex 4A: Farm-Nonfarm Linkages and Microenterprise Performance

The ability of farm-nonfarm linkages to affect growth and poverty can depend heavily on initial conditions related to agriculture. Many studies have shown that nonfarm income growth in rural areas, at least at the outset, depends on growth in agricultural productivity (Deichmann, Shilpi, and Vakis 2009; Haggblade, Hazell, and Reardon 2006; Johnson 2000; Johnston and Mellor 1961; Mellor 1976; Ranis and Stewart 1973).

In this context, the varying characteristics of the rural nonfarm sector must also be considered (see Haggblade, Hazell, and Reardon 2006; Lanjouw and Feder 2001). Foster and Rosenzweig (2004), for example, make a distinction between nonfarm goods that are traded and nontraded. Using rural household panel data from India spanning 1970–2000, they find that only nontradable nonfarm activities such as services are positively influenced by agricultural productivity growth. In contrast, tradable nonfarm activities such as small manufacturing move into areas with lower wages, implying a negative relationship with agricultural productivity growth.

Using individual employment data from the 2000 HIES of Bangladesh, Deichmann, Shilpi, and Vakis (2009) examined the effects of rural farm-nonfarm linkages by dividing nonfarm activities into low-return wage work (paying equal to or less than the median agricultural wage of a village), high-return wage work, and self-employment. They found that proximity to urban centers matters greatly for high-return nonfarm activities: high-return nonfarm wage work and self-employment. Agricultural potential also matters, but through its interaction with access to urban centers. In fact, more isolated regions with greater agricultural potential are much less likely to engage in these high-return activities.[9] The results highlight the importance of connectivity for high-return employment.

Haggblade, Hazell, and Reardon (2010) discuss two scenarios where urban linkages and growth in the RNF sector can affect agriculture. In dynamic agricultural regions, there can be a "pull" scenario (see the section "Farm and Rural Nonfarm Linkages" in the main text of this chapter) in which new agricultural technologies increase output for certain commodities, and hence improve opportunities for trade of these goods. The nonfarm sector in those regions can also provide inputs and services that new agricultural technology or processes may be dependent on, including better seed and fertilizer, capital equipment, and other services such as credit and marketing or distribution.

Improved infrastructure also plays an important role in creating a "pull" scenario. On the household side, productivity improvements can free up time for nonfarm activities, and as households' incomes grow, their consumption of nonfood items can also increase, further raising opportunities for households to meet the growing demand by entering the nonfarm sector. As real wages increase, subsistence nonfarm activities give way to higher-return activities in manufacturing and services. Poor households, therefore, benefit directly from real wage increases as well as improved higher-return opportunities from nonfarm self-employment.

In contrast to the "pull" scenario, a "push" scenario can prevail in stagnant agricultural regions. Where the agricultural base is sluggish, the response of agriculture to innovations is not likely to be strong, and agriculture's contribution to nonfarm growth and broader economic development would be limited. Weak productivity gains in a sluggish agricultural base lead to lower growth in consumer demand, and hence in entrepreneurial and wage-earning opportunities. Sometime migration to urban areas is one way for the poor households to become engaged in nonfarm activities and support agricultural incomes. When such opportunities do not exist, poor households may become trapped in low-return, local nonfarm activities (such as making or trading small items) to supplement their income. The resulting interaction between agricultural productivity and different types of nonfarm income growth—and their joint effects on poverty reduction—are therefore highly dependent on prevailing local conditions, including the agricultural potential of the area in question.

Table 4A.1 Household Welfare by Microenterprise Adoption, 2000–10

	2000		*2005*		*2010*	
Welfare indicators	*HHs with enterprise as an additional activity (25.6%) (N = 1,290)*	*HHs without enterprise as an additional activity (74.4%) (N = 3,740)*	*HHs with enterprise as an additional activity (21.8%) (N = 1,317)*	*HHs without enterprise as an additional activity (78.2%) (N = 4,714)*	*HHs with enterprise as an additional activity (21.6%) (N = 1,701)*	*HHs without enterprise as an additional activity (78.4%) (N = 6,139)*
Per capita income (BDT/month)	1,185.1	779.5	1,209.7	851.4	1,635.5	1,185.2
	(t = 5.98)		(t = 10.50)		(t = 5.42)	
Per capita expenditure (BDT/month)	788.3	702.1	1,055.4	879.7	1,318.1	1,182.6
	(t = 5.97)		(t = 6.92)		(t = 5.53)	
Moderate poverty head count (%)	49.2	58.0	33.5	42.7	26.2	34.8
	(t = –5.48)		(t = –6.01)		(t = –6.71)	
Extreme poverty head count (%)	33.5	44.1	20.5	28.1	15.0	20.9
	(t = –6.73)		(t = –5.53)		(t = –5.38)	

Note: BDT = Bangladesh taka; HH = household.

Table 4A.2 Impact of Credit and Noncredit Constraints on Microenterprise Productivity (HIES Sample)

	Upazila FE		*Upazila FE with IV*	
Explanatory variables	*Log profit (BDT/year)*	*Profit margin*	*Log profit (BDT/year)*	*Profit margin*
Year is 2005 (1 = yes, 0 = no)	5.593*	0.726*	–0.512	–0.061
	(1.78)	(1.82)	(–1.53)	(–1.35)
Year is 2010 (1 = yes, 0 = no)	4.837	0.901**	–0.652	0.131
	(1.59)	(2.34)	(–1.04)	(1.30)
Enterprise is credit-constrained	0.017	–0.072**	0.226	–0.088**
	(0.14)	(–5.36)	(1.18)	(–3.61)

table continues next page

Table 4A.2 Impact of Credit and Noncredit Constraints on Microenterprise Productivity (HIES Sample) *(continued)*

	Upazila FE		*Upazila FE with IV*	
Explanatory variables	*Log profit (BDT/year)*	*Profit margin*	*Log profit (BDT/year)*	*Profit margin*
Enterprise is noncredit-constrained	−0.011	−0.044**	−0.043	−0.087**
	(−0.08)	(−3.15)	(−0.22)	(−3.85)
Activity is manufacturing	0.637**	0.013	0.625**	−0.001
	(2.66)	(0.41)	(2.41)	(−0.03)
Activity is transport	0.824**	0.233**	0.956**	0.234**
	(3.86)	(7.36)	(4.07)	(7.07)
Activity is trade	0.572	0.008	0.358	−0.015
	(1.56)	(0.17)	(1.00)	(−0.30)
Activity is service sector	0.357*	−0.063**	0.387*	−0.069**
	(1.74)	(−2.40)	(1.71)	(−2.48)
Log value of enterprise capital asset (BDT)	0.997**	0.042**	1.165**	0.044**
	(19.13)	(7.89)	(20.07)	(8.98)
R^2	0.402	0.280	0.343	0.253
Endogeneity test for endogenous regressors			$\chi^2(2) = 2.108$, $p = 0.349$	$\chi^2(2) = 7.298$, $p = 0.026$
Overidentification test for instruments (Hansen J statistics)			$\chi^2(8) = 8.731$, $p = 0.366$	$\chi^2(8) = 11.333$, $p = 0.184$
Underidentification test for instruments (KP statistics)			$\chi^2(9) = 114.52$, $p = 0.000$	$\chi^2(9) = 114.52$, $p = 0.000$
Weak identification for instruments (CD statistics)			$F = 172.99$	$F = 172.99$
Stock-Yogo weak identification test critical value for 5% bias			18.76	18.76

Sources: BBS, HIES 2000, 2005, 2010.
Note: Figures in parentheses are *t*-statistics. Excluded enterprise category is miscellaneous activities. Regression also controls for enterprise characteristics such as enterprise age, months of operation per year, whether it is home-based, and household and community characteristics, and exogenous characteristics of the initial year and household occupation dummies based on major income source. BDT = Bangladesh taka; CD = Cragg-Donald; FE = fixed effects; HIES = Household Income and Expenditure Survey; IV = instrumental variable; KP = Kleibergen-Paap. *N* = 4,762.
Significance level: * = 10 percent, ** = 5 percent.

Table 4A.3 Impact of Credit and Noncredit Constraints on Microenterprise Productivity (WBI Sample)

	HH FE		*HH FE with IV*	
Explanatory variables	*Log profit (BDT/year)*	*Profit margin*	*Log profit (BDT/year)*	*Profit margin*
Year is 2010–11 (1 = yes, 0 = no)	−0.190	−0.549	−0.336	−0.343*
	(−0.04)	(−1.45)	(−0.17)	(−1.86)
Enterprise is credit-constrained	−0.729**	−0.027	−0.829	−0.280*
	(−2.44)	(−0.58)	(−0.94)	(−1.66)
Activity is manufacturing	1.363**	−0.168**	1.533**	−0.150**
	(3.06)	(−3.07)	(3.51)	(−2.77)

table continues next page

Table 4A.3 Impact of Credit and Noncredit Constraints on Microenterprise Productivity (WBI Sample) *(continued)*

	HH FE		*HH FE with IV*	
Explanatory variables	*Log profit (BDT/year)*	*Profit margin*	*Log profit (BDT/year)*	*Profit margin*
Activity is agricultural trading	1.505**	−0.163**	1.416**	−0.161**
	(4.18)	(−4.37)	(4.10)	(−4.59)
Activity is nonagricultural trading	2.139**	−0.086**	2.086**	−0.082**
	(6.42)	(−2.90)	(6.30)	(−2.77)
Activity is service sector	1.661**	−0.059	1.725**	−0.046
	(2.73)	(−1.21)	(2.75)	(−0.97)
Log value of enterprise capital asset (BDT)	1.680**	0.101**	1.687**	0.098**
	(23.94)	(20.41)	(25.64)	(21.74)
R^2	0.608	0.644	0.593	0.602
Endogeneity test for endogenous regressors	n.a.	n.a.	$\chi^2(1) = 0.130$, $p = 0.718$	$\chi^2(1) = 4.393$, $p = 0.036$
Overidentification test for instruments (Hansen J statistics)	n.a.	n.a.	$\chi^2(7) = 11.178$, $p = 0.083$	$\chi^2(7) = 5.308$, $p = 0.505$
Underidentification test for instruments (KP statistics)	n.a.	n.a.	$\chi^2(7) = 10.01$, $p = 0.188$	$\chi^2(7) = 9.325$, $p = 0.230$
Weak identification for instruments (CD statistics)	n.a.	n.a.	$F = 6.560$	$F = 6.505$
Stock-Yogo weak identification test critical value for 5 percent bias	n.a.	n.a.	19.86	19.86

Sources: WB-BIDS surveys 1991–92, 1998–99; WB-InM survey 2010–11.
Note: Figures in parentheses are *t*-statistics. Excluded enterprise category is transport activity. Regression also controls for enterprise characteristics such as enterprise age, months of operation per year, whether it is home-based, and household and community characteristics, and in addition, exogenous characteristics of the initial year and household occupation dummies based on major income source. BDT = Bangladesh taka; CD = Cragg-Donald; FE = fixed effects; HH = household; IV = instrumental variable; KP = Kleibergen-Paap; n.a. = not applicable.
Significance level: * = 10 percent, ** = 5 percent.

Table 4A.4 Determinants of Credit and Noncredit Constraints Faced by the Enterprises (FE Logit)
N = 4,762

Explanatory variables	*Credit constraints*	*Noncredit constraints*
Year is 2005 (1 = yes, 0 = no)	0.196	−0.084
	(0.88)	(−0.29)
Year is 2010 (1 = yes, 0 = no)	0.522**	0.036
	(2.20)	(0.11)
Sex of the owner (1 = male, 0 = female)	−0.031	−0.018
	(−0.86)	(−0.56)
Age of the owner (years)	−0.001	−0.0002
	(−0.95)	(−0.29)
Education of the owner (years)	−0.004**	0.003
	(−2.27)	(1.56)

table continues next page

Table 4A.4 Determinants of Credit and Noncredit Constraints Faced by the Enterprises (FE Logit) *(continued)*
N = 4,762

Explanatory variables	*Credit constraints*	*Noncredit constraints*
Log HH land (decimals)	0.001	−0.005
	(0.27)	(−0.97)
Log HH nonland asset (Tk)	−0.022**	0.023**
	(−2.74)	(2.57)
Years the enterprise has been in business	0.001**	−0.003**
	(2.12)	(−3.25)
Enterprise is formally registered (1 = yes, 0 = no)	−0.046**	0.005
	(−2.41)	(0.20)
Enterprise is household-based (1 = yes, 0 = no)	−0.059**	0.026
	(−3.37)	(1.16)
Number of total employees	−0.004**	0.012**
	(−2.22)	(3.12)
Share of hired labor in total workforce	−0.031	0.109**
	(−1.02)	(2.70)
Enterprise is in manufacturing sector (1 = yes, 0 = no)	0.070**	−0.056
	(2.28)	(−1.53)
Enterprise is in transport sector (1 = yes, 0 = no)	−0.115**	0.001
	(−3.97)	(0.04)
Enterprise is in trade sector (1 = yes, 0 = no)	−0.005	−0.069
	(−0.10)	(−1.23)
Enterprise is in service sector (1 = yes, 0 = no)	0.115**	−0.035
	(4.45)	(−1.17)
Village has electricity (1 = yes, 0 = no)	−0.048*	0.027
	(−1.85)	(0.75)
Village has paved roads (1 = yes, 0 = no)	0.010	−0.015
	(0.41)	(0.48)
Share of village land irrigated	0.079*	0.030
	(1.64)	(0.46)
Village has commercial banks (1 = yes, 0 = no)	−0.006	0.022
	(−0.19)	(0.54)
Village has microcredit organizations (1 = yes, 0 = no)	0.051	0.031
	(1.08)	(0.49)
R^2	0.093	0.104

Sources: BBS, HIES 2000, 2005, 2010.
Note: Figures in parentheses are *t*-statistics. Excluded enterprise category is miscellaneous activities. Regression also controls for enterprise characteristics such as enterprise age, months of operation per year, whether it is home-based, and household and community characteristics, and in addition, exogenous characteristics of the initial year and household occupation dummies based on major income source. FE = fixed effects; HH = household; Tk = taka.
Significance level: * = 10 percent, ** = 5 percent.

Notes

1. RNF activities have long been recognized as an integral part of the rural economic landscape; see Lanjouw and Lanjouw (2001); Lanjouw and Feder (2001).
2. Given the current age structure, the labor force is expected to continue expanding for some time, even as the population growth rate continues to decline.
3. The main sources of information on activities in the RNF sector used in this report are (at the national level): (a) BBS, HIES 2000, 2005, and 2010 and (b) BBS, LFSs 2002–03, 2005–06, and 2010. At the micro level, the main sources of information are: (a) the BIDS-IRRI-BRAC Household Panel Surveys (1987–2013) (five rounds); (b) the WB-BIDS-InM longitudinal panel surveys (1991–92 to 2010–11, three rounds); and (c) the BIHS IFPRI Survey of 2011–12 (one round).
4. More specifically, microenterprises are defined to include manufacturing and processing industries, transport, trade, services, and other miscellaneous activities. They do not include farm-related activities such as crop production, poultry raising, cow fattening, fish farming, and other small farm activities.
5. Many scholars (such as Timmer) stress that transformation is a desirable goal not only because it leads to higher incomes and employment but also because it is essential for sustained growth in agriculture. According to Timmer, policy must focus on strengthening and not retarding this transformation. Some scholars have pointed out that heavy input subsidies for cereals (to attain self-sufficiency in food) in some economies may actually retard the transformation. Timmer (2005) finds that policies favoring input subsidies are slowing transformation in Bangladesh as well as in India.
6. Rates of return are estimated to have been even higher for 2000 and 2005, ranging from 60 percent to 76 percent in 2000 and from 54 percent to 76 percent in 2005, with the highest returns accruing to transport activities in both years.
7. Similar information on categories of constraints is not available from the WBI or MH panel surveys.
8. The WBI data contain information only on credit constraints, not on any noncredit constraints.
9. They also find that low-return nonfarm jobs are driven by local demand and are distributed much more evenly across geographical areas. Access to smaller rural towns (with a population of about 5,000), as opposed to access to urban centers, has little effect on nonfarm activities except for nontradable service works.

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CHAPTER 5

Connecting Farmers to Markets: Trading in High-Value Products

Introduction

Urbanization, sustained income growth, and the decline in poverty are continuing to change consumption patterns and heighten demand for a more diverse range of agricultural products.[1] At the same time, as discussed in chapter 4, producers across Bangladesh need to diversify to raise productivity and agricultural income in a sustainable way. For these demand and supply imperatives to converge—for farmers to gain appropriate incentives to diversify, and for the costs to consumers to fall—markets must be accessible and value chains must be efficient. Infrastructure investments and agricultural policy reforms in the past two decades have assisted the marketing of agricultural products by crowding in private investment in trade, transport, and other services. The rice subsector has benefited substantially from these changes: the sustained increase in per capita rice availability through domestic production helped Bangladesh emerge as the highest per capita consumer of rice in the world and Asia's highest per capita consumer of cereals (FAO 2013).

Now other agricultural subsectors must have the chance to benefit. Domestic consumption of high-value noncereal products—particularly horticultural produce (vegetables and fruits) and animal products (fish, poultry, eggs, milk, and meat)—is expected to grow at a much faster pace than consumption of cereals in the coming decades (Hossain and Deb 2011). Increased demand for fresh produce in the Middle East and other countries will be another source of growth through exports of these products. The growing domestic and external demand for high-value products offers a unique opportunity to raise farmers' incomes more rapidly. It also presents an opportunity to continue to increase and diversify rural nonfarm employment and income growth through trading and eventually agroprocessing and value addition.

The problem with this scenario, as generally perceived in Bangladesh, is that poorly developed market channels hinder the production of crops, especially high-value crops. A particular concern is the behavior of traders and other market

intermediaries (which is widely perceived to be uncompetitive), along with distortions in transporting and marketing (especially rent-seeking and extortion along the value chains). The resulting marketing inefficiency and high costs hurt producers and consumers alike. Inefficiency constrains the chances of fully realizing Bangladesh's agricultural production potential based on comparative advantage.

Technical issues (such as the need for cold chains and storage) are cited alongside structural issues (such as alleged oligopolistic behavior among traders) as creating barriers to the development of more efficient supply chains. Few studies have looked at marketing issues in depth, however, or firmly established that widespread distortions are present in agricultural supply chains in Bangladesh. A cross-country study of rice and potato markets in Bangladesh, India, and China found that markets functioned better in Bangladesh than in the other countries. Another study by the International Food Policy Research Institute (IFPRI), however, found some evidence of market manipulation by onion traders in the recent onion crisis (Ahmed and Ahmad 2013), but for other major crops there is little evidence to document any major distortions.

A detailed analysis of value chains can identify the major marketing constraints. World Bank (2008a) examines constraints and opportunities for selected products of high-value agriculture, including fisheries, poultry, fruits and vegetables, high-value rice, and dairy, and delivers specific policy recommendations for each one. Focusing on production technology and export potential, and based on concerns raised by various stakeholders, the report concludes that better governance is needed to reduce the informal tolls levied against fresh produce as it moves from farm to market, but the report contains no empirical analysis to establish the extent and nature of distortions or their likely impact on marketing costs.

The broader policy and institutional issues highlighted by this 2008 report remain valid, so the analysis is not repeated here. Instead this report complements those findings and recommendations with an in-depth empirical analysis of domestic marketing channels, focusing on the constraints to developing an efficient marketing system for perishable products.

Accordingly, a series of Agricultural Value Chain Surveys conducted in 2014 collected detailed information from farmers and different types of traders operating at different layers and locations of markets along the value chains for four products. The value chains serve domestic markets, and the four products figure prominently in the traditional Bangladeshi diet: vegetables, fish, poultry, and milk. Eggplant (*brinjal*) was chosen for the study on vegetable value chains because it is consumed widely in Bangladesh, and its value chain is similar to that of other widely consumed vegetables such as tomatoes, onions, and cauliflower.[2] Blue catfish (*pangash*) was chosen for the fish value chain study. Brinjal is widely consumed by rich and poor, whereas pangash has come to be known as the "poor man's most reliable source of protein." Mass production of chicken in modern poultry farms has made it affordable for most consumers. Milk consumption in Bangladesh, on the other hand, is relatively low but expected to grow rapidly. For a description of the surveys and their design, see annex 5A.

The surveys differ from other value chain studies in several important ways. Rather than just focusing on the estimation of margins, the surveys collected detailed information on all trading practices, including credit and other contractual arrangements, transportation, damages and losses, sources of information, enforcement of contracts, and security of property. The surveys also collected useful information on constraints faced by traders through an opinion survey focusing on the investment climate. A separate survey of all major markets assembled information on physical facilities at the market locations. The trader, market, and farmer surveys were also interlinked to learn how a constraint affecting a given layer might affect cost and conduct in all other layers. These detailed and interlinked surveys make it possible not only to estimate margins at different market layers but also to analyze the determinants of those margins in terms of infrastructure, facilities, and other policy variables.

Value Chains of High-Value Products

While some share of these high-value products is sold directly to consumers, each product is marketed differently depending on its perishability and geographical coverage. The most common marketing channels for the four products are shown in table 5.1.

The traditional marketing channel for highly perishable products such as milk has very few layers. Most milk marketed through the informal marketing channel—which accounts for 80 percent of milk consumption—is sold by farmers directly to consumers and sweet producers or to traders (mostly small wholesale and retail traders), who sell on to consumers and sweet producers. At the other extreme, brinjal—which is less perishable—goes through many

Table 5.1 Marketing Channels for Brinjal, Pangash, Chicken, and Milk

Brinjal	*Pangash*	*Chicken*	*Milk*
Farmer → consumer	Farmer → consumer	Farmer → consumer	Farmer → consumer or sweet producer
Farmer → bepari → paikar → retailer → consumer	Farmer → local aratdar → local retailer → consumer	Farmer → local wholesaler → local retail → consumer	Informal: Farmer → aratdar → consumer or sweet producer
Farmer → bepari → aratdar → paikar or wholesale → retailer → consumer	Farmer → bepari → aratdar → paikar or wholesale → retailer → consumer	Farmer → local wholesaler → bepari → aratdar → wholesale or paikar → retail → consumer	Formal: Farmer → cooperative → processor → retailer → consumer
		Farmer → local wholesaler → bepari → aratdar → retail → consumer	

Source: Shilpi et al. 2015.
Note: *Aratdar* is a wholesale trading service; *bepari* is a rural assembler; *brinjal* is eggplant; *paikar* is a wholesale distributor; *pangash* is blue catfish.

layers of traders before reaching consumers in urban centers. The poultry and fish supply chains lie somewhere between these extremes. Milk also has a formal marketing channel: cooperatives collect milk from farmers and send it to processors through chilling centers, which sell it in turn to consumers and sweet producers, either directly or through retailers. Because of its high perishability, milk marketed through informal, traditional channels travels only short distances, whereas a less perishable product such as brinjal is sold in urban markets far from growing areas. A detailed description of the supply chains for each product covered under the study is given in Shilpi et al. (2015).

Characteristics of Traders

Traders perform a variety of roles in the supply chain. All traders along the supply chain engage to some extent in grading, sorting, weighing, packaging, storing, and transporting produce. The roles of different traders along the supply chain are not clearly demarcated—they may differ across market locations and products. For example, *aratdars* are the largest traders by volume; they typically consolidate supplies that come from farmers, often through other traders, and then distribute those supplies to consumers through still other traders. In many local markets, aratdars act like commission agents, never taking physical possession of the good, but in most markets, they engage in sorting, grading, packaging, storing, and transporting of the products. In the poultry value chain, aratdars are more like dealers who supply chicks, feed, and medicine to farmers, mostly on credit, and then make sales arrangements with buyers of fully grown chickens. These dealers charge no commission but get paid from the sales proceeds (in other words, the commission is built into the prices). The next traders in terms of size are *paikars* (wholesale traders), who operate downstream or upstream from aratdars and act as an intermediate step after farmers or before retailers. In the case of brinjal, pangash, and chicken, *beparis*, or *farias* (rural assemblers) collect the product from the farmer; they are included with wholesalers in the data analysis. Some of the smaller wholesale traders also act as retailers, selling directly to consumers. The retail traders typically deal with many products, and the average size of each sale is usually much smaller than that of wholesale traders.

The majority of traders are young and relatively educated. While the average age of farmers is above 40 years in Bangladesh, two-thirds of the traders engaged in supplying high-value products are younger than 40. Some products that are expected to experience higher future growth, such as fish and poultry, are attracting much younger and more educated traders. Similarly, younger and more educated individuals are increasingly entering the upstream (aratdar, or wholesale) trading services, which will play an important role in the consolidation of supply chains in coming years. This trend is actually present in farming practices for these products as well. For instance, farmers engaged in fish production have on average two more years of schooling than

other farmers and are much younger on average (about 38 years) compared with producers of other commodities (44 years). Moreover, a substantial proportion of farmers engaged in fish and poultry production reported a secondary occupation in trading. The entry of younger and more educated farmers and traders in the production and distribution of these products is a positive sign of progress in the farming sector in Bangladesh.

Characteristics of Trading Enterprises

Total sales by aratdars over a three-month period were about 101 tons for brinjal, 34 tons for pangash, and 59 tons for chicken (table 5.2). The average size of sales for wholesale traders is slightly more than half of the aratdars' sales. Compared with aratdars and wholesale traders, sales by retail traders are very small, on the order of 2 tons for all goods except chicken (5 tons). Traders in the milk supply chain deal with much smaller quantities compared with traders of other products.

Trading enterprises dealing with different products are different in key dimensions (tables 5.3 and 5.4). For instance, most traders either own a shop or use a residence as a place of business for all products except milk. Milk marketed through the traditional channel is either delivered to consumers directly by farmers or brought to the market at a fixed time of day (morning) by farmers and then bought, loaded into vans or buses, and delivered to consumers by traders. Because of these marketing arrangements, few traders—with the exception of large ones—need to have a fixed space or shop at the market. In terms of owning equipment, most trading enterprises are low-technology operations with phones, scales, and some processing equipment. The working capital requirements for trading enterprises are higher for chicken and milk compared to pangash and brinjal.

The enterprise size varies by type of trader as well (table 5.4). The median working capital required by aratdars is about 3 times that of wholesale traders and 12 times that of retail traders. Aratdars also tend to use computers more often (17 percent) and own motorized vehicles more often (19 percent) compared to other traders. More important, they use more formal banking services: 8 percent have an overdraft facility, compared with less than 1 percent of other traders.

Table 5.2 Sales in Last Three Months (Sample Median), 2015

Value chain	*Aratdar*	*Large wholesale*	*Wholesale and retail*	*Retail*	*All*
Brinjal (t)	101	56	3	2	16
Pangash (t)	34	27	9	2	9
Chicken (t)	59	33	18	5	10
Milk (000 liters)	n.a.	9	n.a.	2	3

Source: Shilpi et al. 2015.
Note: *Aratdar* is a wholesale trading service; *brinjal* is eggplant; *pangash* is blue catfish. t = ton (metric); n.a. = not applicable.

Table 5.3 Characteristics of Trading Enterprises in the Four Value Chains, 2015

	Brinjal	*Pangash*	*Chicken*	*Milk*
Equipment (% traders)				
Residence serves as selling or purchasing place	14.37	17.73	17.85	3.03
Owns shop or storage facility in a market	65.75	86.32	83.49	15.13
Owner of … (%)				
Mechanical scales	48	68	64	45
Processing equipment	13	46	53	70
Generator	2	1	4	3
Telephone	84	90	93	80
Computer	8	11	1	3
Nonmotorized transportation	17	9	19	26
Motorized vehicles	7	14	16	7
Uses electricity in trading business	60	63	82	16
Labor: total number of workers over last year				
Total (median)	5	5	5	5
Capital: average working capital of the enterprise (BDT) over the last 12 months				
Median	30,000	50,000	100,000	100,000
Capital: proportion of traders receiving finance from (%):				
Bank	5.25	2.61	9.72	4.03
Overdraft facility	2.07	3.07	2.59	0

Source: Shilpi et al. 2015.
Note: *Brinjal* is eggplant; *pangash* is blue catfish. BDT = Bangladesh taka.

Table 5.4 Characteristics of Trading Enterprises, by Type of Trader, 2015

	Aratdars	*Wholesale*	*Retail*	*Wholesale and retail*
Equipment (% of traders)				
Residence serves as selling or purchasing place	19.78	10.69	16.87	19.31
Owns shop or storage facility in a market	95.03	50.66	80.53	87.93
Owner of … (%)				
Mechanical scales	62.78	44.72	68.29	64.29
Processing equipment	23.33	27.13	54.36	62.16
Generator	1.11	3.41	2.18	0
Telephone	97.22	90.94	82.05	90.18
Computer	17.22	6.25	3.69	2.70
Nonmotorized transportation	7.22	21.59	16.11	7.21
Motorized vehicles	18.89	18.94	3.36	6.36
Uses electricity in trading business	74.59	46.90	68.72	82.76
Labor: total number of workers over last year				
Total (median)	6	5	5	5
Capital: average working capital of the enterprise (BDT) over the last 12 months				
Median	300,000	100,000	25,000	60,000
Capital: proportion of traders receiving finance from (%):				
Bank	7.73	4.23	5.89	7.08
Overdraft facility	8.29	2.81	0.17	0.86

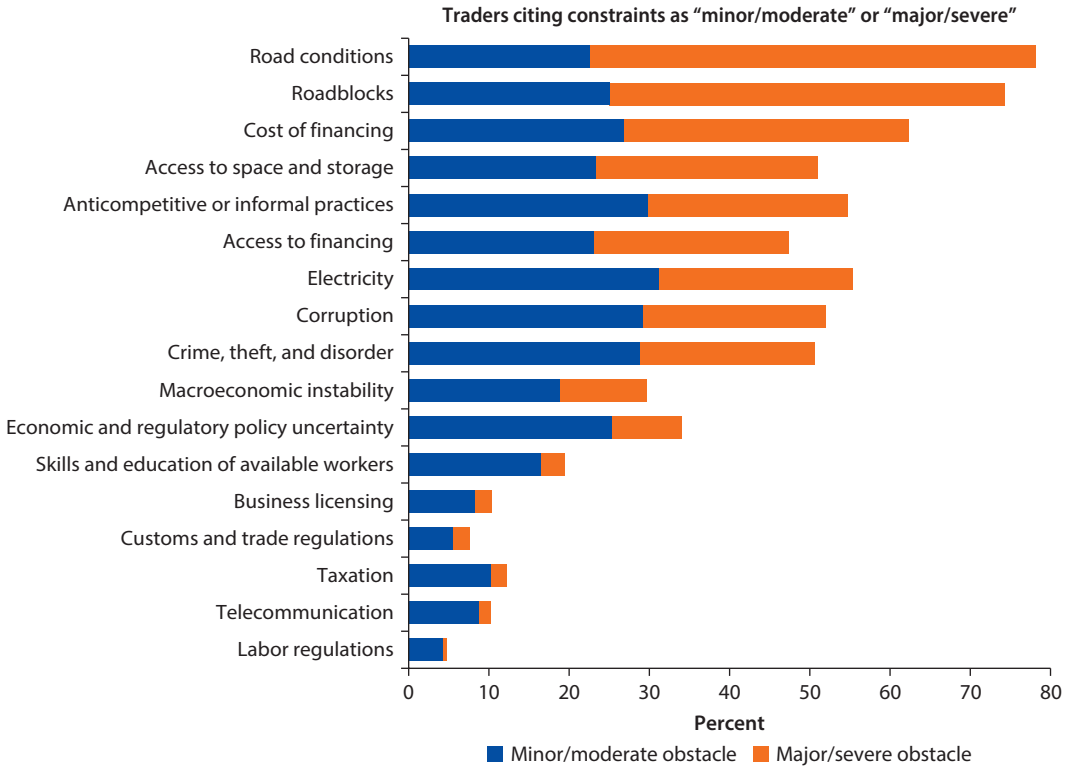
Source: Shilpi et al. 2015.
Note: *Aratdar* is a wholesale trading service. BDT = Bangladesh taka.

Investment Climate for Agricultural Value Chains

Traders along the value chain make a number of decisions, including day-to-day operational decisions and longer-term expansion decisions related to their enterprise, depending on their assessment of prevailing conditions and prospects. Detailed information collected as part of the surveys sheds light on traders' perceptions of the constraints limiting their operations. The respondents were asked to rate each of 17 different problems as a constraint to their business on a scale of 0–4, in which 0 indicated no problem and 4 indicated a severe problem.[3] Two Investment Climate Assessment (ICA) scores are estimated on the basis of these responses. The ICA score for a major or severe problem for a given constraint is computed as the percentage of traders citing it as a severe or major obstacle. The score of minor or moderate is similarly computed as the percentage of traders citing a constraint as a minor or moderate problem.

The major or severe constraints identified by traders were poor road conditions and roadblocks, limited access to and cost of financing, lack of shop or storage space, anticompetitive behaviors, unreliability of electricity, corruption, and crime and theft (figure 5.1). More than half of the traders viewed poor road conditions and roadblocks as major or severe problems, and another one-fourth

Figure 5.1 Traders' Perceptions of Obstacles to Business Operation



Source: Shilpi et al. 2015.

rated them as minor or moderate problems. The cost of financing is rated as a major or severe constraint by 37 percent of traders, while another 24 percent cited problems accessing credit. More than one-fifth of respondents reported the lack of storage or shop space; anticompetitive behaviors; unreliability of electricity supply; corruption; and crime, theft, and disorder as major or severe problems. The traders' rankings of constraints are similar to rankings provided by operators of medium and small rural enterprises in Investment Climate Surveys (World Bank 2008b).

Some variation occurs in the rankings of constraints by traders operating at different layers of the value chain and dealing with different types of products. For fish traders, the biggest concerns are road conditions (62 percent) and roadblocks (54 percent). For milk traders, access to and cost of finance are the biggest constraints (42 percent and 24 percent, respectively). For 37 percent of poultry traders, the unreliable electricity supply was the main concern. Access to storage and shop space is a major issue for fish and vegetable traders. Among aratdars, road conditions and roadblocks are the most important constraints (72 percent and 66 percent, respectively), followed by the cost of financing and lack of storage space (35 percent each). Wholesale traders rank road conditions and blocks as the biggest constraints (63 percent and 59 percent, respectively), followed by the cost of financing (42 percent) and anticompetitive practices (28 percent). The most severe constraint for retail traders, on the other hand, is unreliability of electricity supply (35 percent), followed by roadblocks and cost of financing.

Decomposing Marketing Costs and Margins

Traders' perceptions of constraints are subjective and may not always coincide with objective measures of constraints in trading. This section looks at some objective measures (traders' actual costs and margins) to assess the possible obstacles to trading activities.

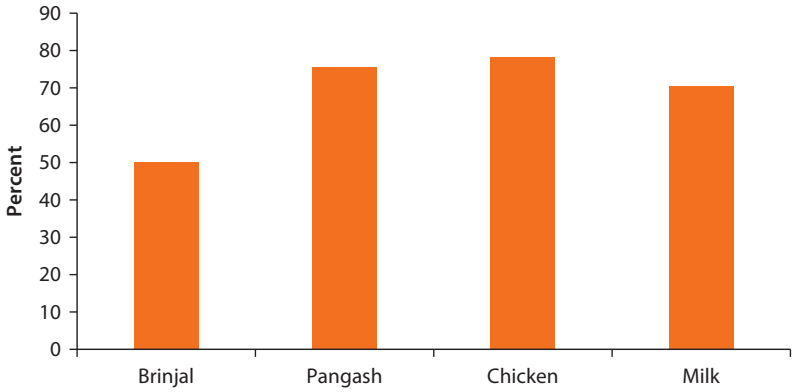
Farmer's Share in Retail Price

The marketing margins implied by the share of the retail price that farmers receive as the farm-gate price vary by product, depending on the perishability and geographical reach of the marketing channel (figure 5.2). The supply chain for brinjal involves many layers and is spread over a wider geographical area than supply chains of the other products surveyed. For this relatively less perishable product, the farm-gate price is about half of the retail price. For all other products, the farmer's share in the retail price ranges from 73 percent (for milk) to 78 percent (for chicken).

Marketing Costs and Margins

Trading margins for all four products are small, once the trader's fixed and variable costs are deducted from the gross margins (sale price – purchase price). In figure 5.3, the height of the bar shows the sale price of the trader; the blue bar is the purchase price. Using the information collected in the surveys, the operating and variable costs of transactions are estimated.[4] The operating and fixed

Figure 5.2 Farmer's Share in Retail Price in the Four Value Chains



Source: Shilpi et al. 2015.
Note: *Brinjal* is eggplant; *pangash* is blue catfish.

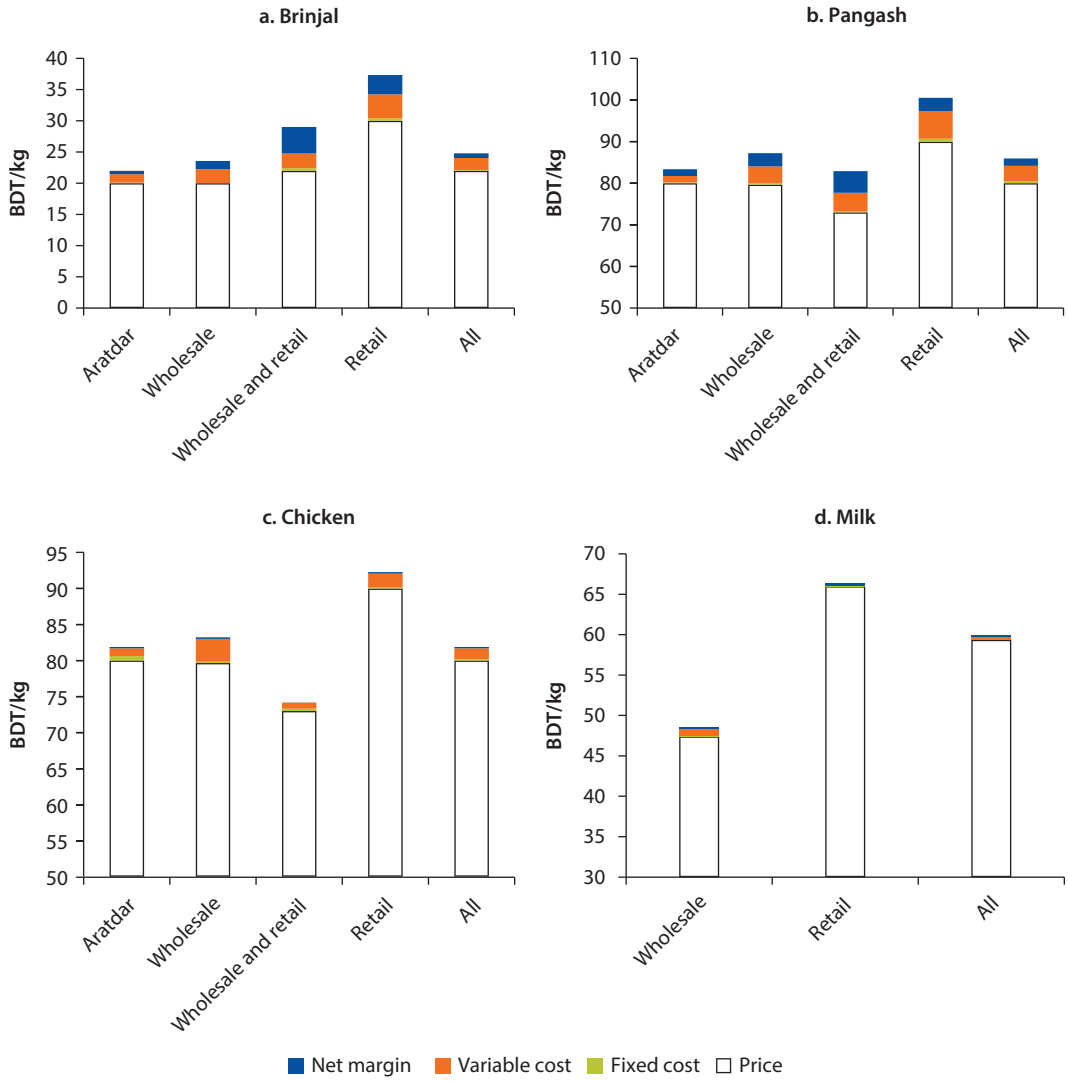
costs consisted of monthly costs of rental, wages, vehicle maintenance costs, licenses, fees, and other general costs (electricity, water, and others). Operating costs per kilogram (liter) were estimated, based on the volume of transactions in a month. Variable costs are estimated from tracking a transaction from its purchase to sale, tracing every step in between in terms of transport, handling, product loss, fees, taxes, storage, and any other costs. The variable costs are also expressed per kilogram (liter) based on the volume of transactions.

Figure 5.3 plots the median of variable and fixed costs. The net margins for chicken and milk are very thin—about 0.2 percent to 0.3 percent. The margins for brinjal and pangash are somewhat larger (3.5 percent for brinjal and 2.2 percent for pangash), yet both can be considered quite reasonable, given that both products travel longer distances and that fish are highly perishable. Among traders, only retail traders of brinjal appear to have relatively higher margins, but the average quantity sold by retail traders is small (roughly around 22 kilograms per day).

The variable costs of trading appear large relative to fixed costs for all products, with the exception of milk. For brinjal and pangash, variable costs are particularly higher at the retail and wholesale levels. Based on detailed cost information from the value chain surveys, figure 5.4 shows the composition of variable costs for traders in each value chain.

Transport costs are major sources of variable costs for all traders (figure 5.4). For instance, transport and handling costs account for 45 percent of wholesale traders' variable costs and 35 percent of the variable costs for retail traders of brinjal. For all types of brinjal traders, the costs of damage and loss are also very high (40 percent of variable costs). The loss due to product damage and loss is particularly high for aratdars and retail traders, accounting for more than half of their variable costs. The high incidence of product loss and damage may explain partly why margins are relatively larger for retail traders, particularly in light of their smaller transaction volumes.

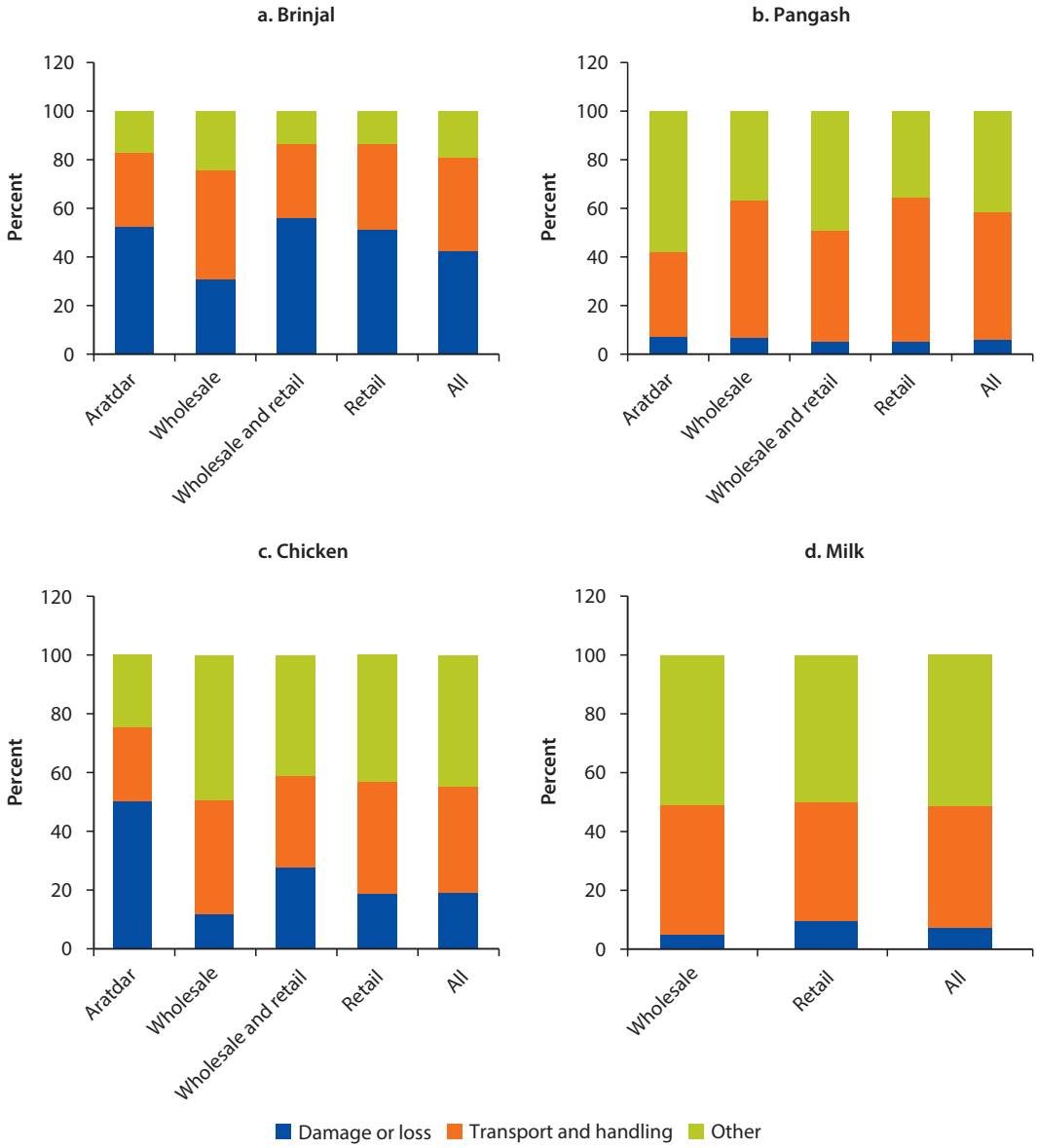
Figure 5.3 Median Marketing Costs and Margins in the Four Value Chains, 2015



Source: Shilpi et al. 2015.
Note: *Aratdar* is a wholesale trading service; *brinjal* is eggplant; *pangash* is blue catfish. *Wholesale and retail* refers to traders engaged in both wholesale and retail business; *all* represents the average across all market participants. Market participants often transact with different agents along the value chain, and the purchase price and costs may vary accordingly. For example, retail traders may buy directly from farmers, wholesalers, or traders. BDT = Bangladesh taka.

The main fish trading costs appear to arise from transport and handling, since fish traders report very little product loss or damage. The large transport costs relative to product damage and loss is due to the ingenious way of transporting and marketing pangash in Bangladesh. Fish are usually packed in boxes and transported in refrigerated trucks in countries with more advanced supply chains, whereas in Bangladesh live fish are transported in water-filled drums. This transport arrangement dramatically reduces product loss even as it increases transport

Figure 5.4 Composition of Traders' Variable Costs in the Four Value Chains

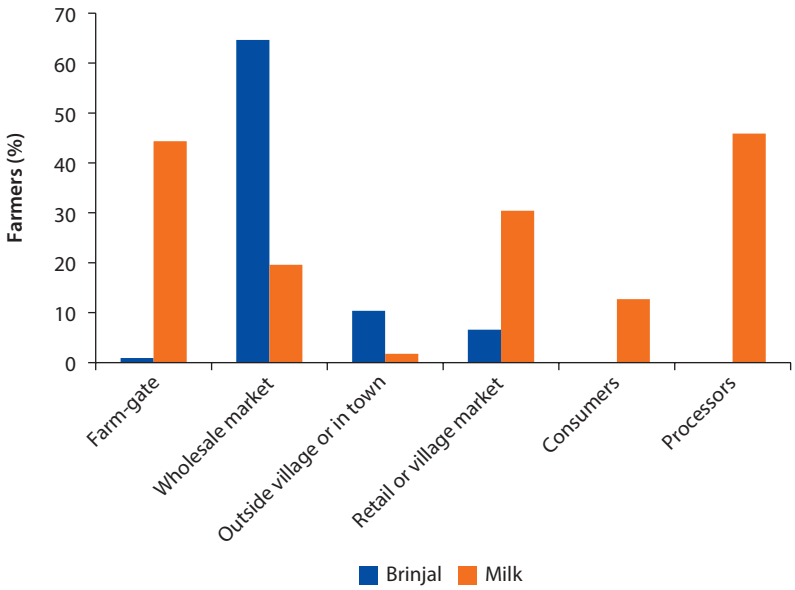


Source: Shilpi et al. 2015.
Note: *Brinjal* is eggplant; *pangash* is blue catfish.

costs, yet it represents a cost-effective way of doing business in a tropical country lacking refrigerated trucks and facing enormous transport delays and blocks.

The gross margins for chicken and milk are very thin, and much of these margins can be explained by transport and handling costs. Though fresh milk is highly susceptible to spoilage, actual losses due to spoilage reported by the traders are small. Indeed, the costs of marketing milk (transport costs, spoilage,

Figure 5.5 Places Where Farmers Sell Brinjal and Milk



Source: Shilpi et al. 2015.
Note: *Brinjal* is eggplant.

operating costs, and so on) are very small. They stand in stark contrast to brinjal, which is much less perishable but involves much larger marketing costs. The reason is that the traditional milk supply chain is short; markets are extremely localized, obviating the need for many intermediaries. The localization of milk trading is reflected in farmers' sales practices (figure 5.5). Only a small percentage of farmers sell milk at wholesale markets (in contrast with brinjal, much of which is sold either in wholesale or retail markets). Most milk is sold at the farm-gate or to processors (80 percent); the rest is sold directly to consumers or at village or retail markets—which is why few milk traders even own or rent a shop at the market.

Extent of Product Loss and Damage

The higher extent of product loss and damage for brinjal and chicken compared to the other products studied is confirmed by trader and market data (figure 5.4). The variable costs described previously were estimated using transaction information (one transaction per trader). Traders also reported the extent of damage and loss for their products over three months. These data indicate that nearly 30 percent of brinjal traders and 26 percent of chicken traders experienced product damage or loss over the three-month period, and their losses ranged from 5 percent (for brinjal) to 2 percent (for chicken). In contrast, only 17 percent of pangash traders and 5 percent of milk traders reported any damage or loss; their losses ranged from 2 percent (pangash) to 4 percent (milk). Most traders sold the

Table 5.5 Product Loss in Rural and Urban Markets
percent

	Causes of product loss			
Product	*Low quality*	*Transportation problem*	*Handling problem*	*Total*
Rural				
Brinjal	3.35	1.40	1.73	6.48
Pangash	2.77	1.93	1.90	6.59
Chicken	1.85	3.43	2.33	7.61
Milk	0	1.67	0	1.67
Urban				
Brinjal	8.50	1.83	3.10	13.42
Pangash	0.81	4.11	5.84	10.76
Chicken	0.01	2.47	2.58	5.07
Milk	0	0	0	0

Source: Shilpi et al. 2015.
Note: *Brinjal* is eggplant; *pangash* is blue catfish.

damaged product at a much lower price, and some reported a loss of weight in their products due to transport delays and longer-than-intended storage periods. Much of the loss or damage is absorbed by the traders themselves (70 percent); in only a few cases were sellers of the product (farmers or traders) made to pay for the damage or loss (7 percent).

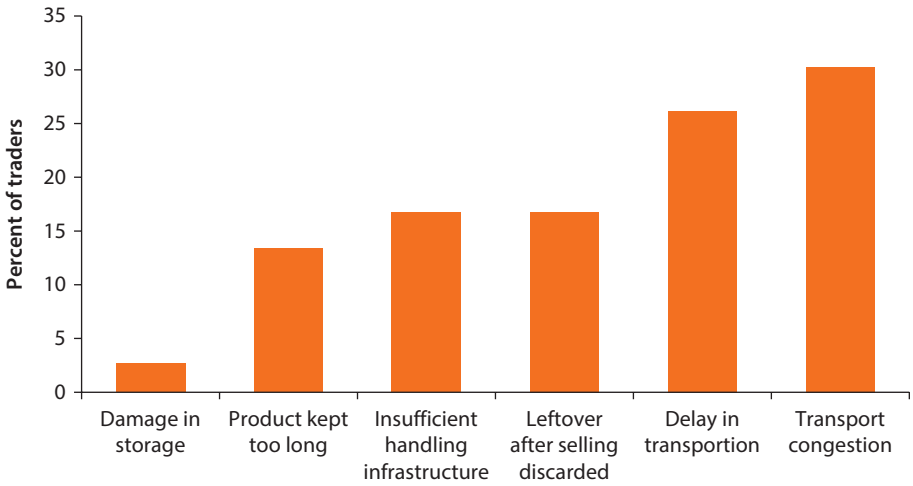
The market data indicate higher levels of damage and loss in urban markets compared with rural markets. For brinjal and pangash, losses in urban markets are twice as large as losses in rural markets, perhaps because these products reach rural markets before they are sent to urban markets (table 5.5). The time delay, along with additional transport and handling, lead to higher losses in the urban markets. Only for chicken were losses higher in rural markets than in urban markets. For milk, losses again were insignificant.

About 30 percent of traders reported transport congestion and another 26 percent reported transport delays as the main reasons for product loss or damage (figure 5.6). Lack of handling infrastructure or facilities is another important reason for product loss and damage.

Market Facilities and Financing Used by Traders

Nearly all of the Bangladesh markets are managed either privately or by local municipalities (unlike India, for example, whose state governments take an active role in managing regulated markets). The sections that follow look more closely at market facilities, including their accessibility, handling of products, storage facilities and costs, electricity and water, and crime and theft. The discussion also covers the finance, trade credit, and advances available to traders.

Figure 5.6 Reason for Product Loss



Source: Shilpi et al. 2015.

Transportation and Market Access

Traders report a range of transportation problems, including delays, congestion, and costs; it is not surprising that road conditions and roadblocks rank among the highest constraints to trading. The question is whether these problems are indicative of problems related to the location and accessibility of markets.

In fact, market density in Bangladesh is relatively high, and nearly 90 percent of farmers have access either to wholesale, retail, or village markets. The majority of the farmers live within 5 kilometers of one of these markets. As a part of the sampling strategy for the value chain surveys, for each primary or village market, one village that was at least 10 kilometers away from that market location was selected. The survey data show that even those relatively more distant villages have other primary markets nearby. Indeed, farmers usually take their products to different markets depending on the day of the week when those markets convene.

In any case, not all farmers sell all products to markets. Farmers sell their brinjal at wholesale markets, whereas most chicken producers sell their product at the farm-gate (20 percent of poultry farmers engage in contract farming). Fish are sold both at the farm-gate and wholesale market (and 41 percent of farmers reported selling through agents). Milk is sold in retail markets or directly to consumers or processors; nearly half of dairy farmers sell milk to cooperatives or processors.

The market survey collected information from 41 of the largest wholesale and retail markets in the sample. Larger markets (wholesale and retail) appear to serve large geographical areas: markets and towns up to 2.18 hours of travel time for rural markets and 3.5 hours for urban markets. Rural markets sell products

that originate less than an hour of travel time away, whereas urban markets sell products originating more than an hour away. Overall, markets are well connected to each other, and access to markets does not appear to be a major issue for farmers. The high density of markets, along with their interconnections, imply that Bangladesh has a highly competitive and geographically integrated marketing system.

Market Facilities and Handling of Products

Poor handling is an important cause of product losses and damage along the supply chain. Information on the state of facilities was collected for the larger and more established markets in rural and urban areas. These markets can be considered well-provided; their facilities are comparable to those in regulated markets in India.

These established markets in Bangladesh fare well in terms of parking and the availability of other services for traders, such as banks, hotels, and post offices (table 5.6).[5] Even so, they lack processing mills, cold storage, and warehouse facilities. Only 12 percent of rural and 4 percent of urban markets reported having cold storage; 35 percent of rural markets and 22 percent of urban markets had warehouses. Tellingly, about 100 percent of cold storage capacity is used, and

Table 5.6 Market Facilities
percent

Share of markets with:	*Rural*	*Urban*
Bus station	47	91
Train station	41	17
Hotels	24	74
Commercial bank	59	83
Post office	71	87
Police station	41	83
Mill	47	87
Storage		
Cold storage (share of markets)	12	4
Current capacity utilization rate	100	100
Warehouse	35	22
Current capacity utilization rate	88	98
Share of traders who store products in shops	41	30
Parking facilities		
Common parking area for all vehicles	56.10	56.52
Separate parking area for trucks	14.63	17.39
Separate parking area for carts	29.27	34.78
Separate parking area for tractors and trolleys	12.20	17.39

table continues next page

Table 5.6 Market Facilities *(continued)*
percent

Share of markets with:	*Rural*	*Urban*
Proportion of stalls or shops have:		
Electricity	87	78
Access to water (piped water)	9	39
Access to water (well)	44	63
Access to water (other source)	7	23
Telephone (landline)	46	45
Mechanical scale	5	3
Electronic scale	13	8
Grading equipment	0	0
Packing machine	31	42

Source: Shilpi et al. 2015.

88 percent to 98 percent of warehouse capacity. A considerable proportion of traders store their products at their shops.

Few markets provide equipment such as scales or packing machines, nor do traders appear to own anything beyond basic scales. Interestingly, rural markets appear to have better access to electricity than urban markets, although rural markets compare unfavorably with urban markets in terms of having a mill, bank, or packing machines. Overall, markets do provide some services but their provision of adequate storage facilities, electricity, and basic equipment is still lacking.

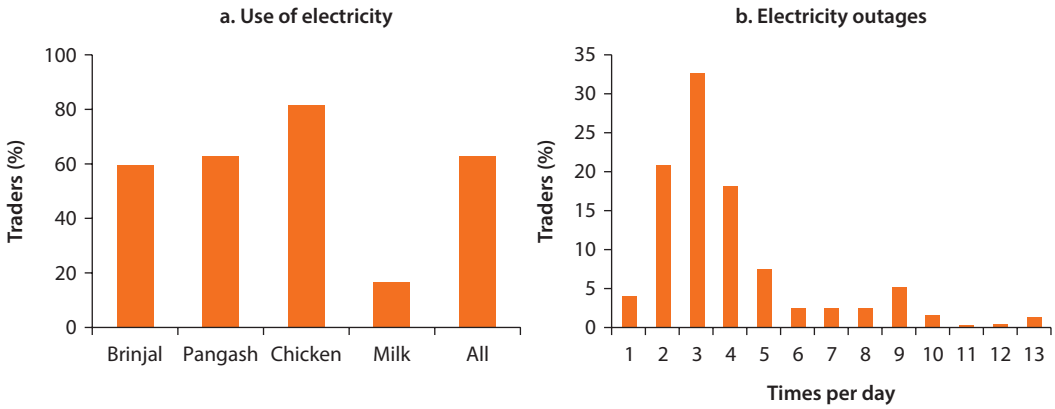
Storage Facilities and Costs

According to the value chain surveys data, most traders use their shops or residences for storage. Only 3 percent reported having a private storage space other than their shop or home. With the exception of traders working in the milk supply chain, most traders in the other supply chains rent shops in the market (table 5.3), and renting a shop is by far the largest operating cost for almost all traders. Storage costs are quite substantial. The cost of renting a shop is about Tk 32 per square foot in rural markets and Tk 45 per square foot in urban markets. Monthly rental for a shop (of average size) varies from Tk 5,300 in rural markets to Tk 7,850 in urban markets.

Use of Electricity and Water

Daily electricity outages can seem as common as rice in the daily Bangladeshi diet. The majority of traders use electricity in their business operations, except for milk traders, who typically do not own or rent a shop (figure 5.7, panel a). Traders ranked the unreliability of electricity as an important constraint on their business. About 80 percent of poultry traders use electricity in their business operation, and the unreliable electricity supply is their topmost concern

Figure 5.7 Use of Electricity in Trading and Electricity Outages



Source: Shilpi et al. 2015.
Note: *Brinjal* is eggplant; *pangash* is blue catfish.

(65 percent perceived it as a constraint, and 37 percent said it was a major or severe constraint). The median number of outages per day is about 3, as reported by traders (figure 5.7, panel b), some of whom reported as many as 13 outages per day. The value chain survey confirms conclusions in the investment climate assessment for Bangladesh (World Bank 2008b): the unreliable electricity supply remains a major constraint, not only for urban firms but also for traders. Indeed, it may be a key reason for the lack of investment in cold storage at markets.

However unreliable the electricity supply may be, connecting to the electricity supply is perhaps even more daunting, requiring considerable patience. According to the market survey data, on average it takes 87 days in rural markets and 102 days in urban markets to get a new electricity connection. Urban markets also fare worse than rural markets in securing a water connection: getting a new water connection takes only 3 days in rural markets but about 100 days in urban markets.

Incidence of Crime and Theft

While it is difficult to measure the economic costs of crime and theft, the agricultural value chain surveys collected quantitative information on the incidence of theft that affects traders directly. About one-fifth of the traders experienced theft of trading goods, except for milk traders (table 5.7). Theft appears to be more of a problem for fish traders, among whom about one-quarter faced theft over the last year. Traders took a number of measures (hiring guards, using locks) to discourage theft. A small percentage faced theft by employees, and 5 percent to 8 percent avoided hiring a new employee because of concerns about theft.

Table 5.7 Theft and Crime
percent

	Brinjal	*Pangash*	*Chicken*	*Milk*
Share of traders who faced theft	17.97	24.76	18.12	7.89
Employees involved in theft	2.07	1.89	3.53	1.97
Measures against theft				
Keep goods under lock and key	24.65	40.33	59.06	40.79
Hire a guard	48.39	67.45	59.29	11.18
Sleep on the premises	4.38	0.94	4.71	1.32
Avoid hiring for fear of theft	6.45	8.73	4.24	7.89
	Aratdar	*Wholesale*	*Retail*	*Wholesale and retail*
Share of traders who faced theft	28.73	19.89	15.64	19.83
Employees involved in theft	3.87	2.63	1.66	3.45
Measures against theft				
Keep goods under lock and key	38.12	40.53	41.93	44.83
Hire a guard	74.03	33.77	61.23	70.69
Sleep on the premises	2.76	6.38	0.83	0
Avoid hiring for fear of theft	8.84	5.63	7.49	2.59

Source: Shilpi et al. 2015.
Note: *Aratdar* is a wholesale trading service; *brinjal* is eggplant; *pangash* is blue catfish.

Access to Finance

Traders operating in markets for high-value products require a substantial amount of working capital. Aratdars report requiring about Tk 400,000 in working capital annually, whereas the median annual working capital requirement was Tk 100,000 for wholesale traders and Tk 25,000 for retail traders (table 5.8). Much of the need for working capital is met by traders from their own funds: 83 percent for aratdars and 85 percent each for wholesale and retail traders. The proportion of traders expressing a need for credit was higher than the proportion of traders who had actually borrowed. For instance, among aratdars, 54 percent needed credit against 47 percent who had actually used credit during the past 12 months. On average, traders approach 12–16 people for credit.

While more traders expressed a need for borrowing, very few actually borrow from formal banks—7.7 percent of aratdars, 4.2 percent of wholesale traders, and 6 percent of retail traders (table 5.8). The ownership of overdraft facilities is also rare among retail and smaller wholesale and retail traders. A considerable proportion of traders (ranging from 43 percent to 30 percent) belong to savings association or chit funds, but the amounts received are relatively small.

The limited access to formal financing and use of bank loans and overdraft facilities could result from unwillingness on the part of traders to engage with the formal banking sector or their inability to secure a loan from these sources. In the rural investment climate survey (World Bank 2008b), small and medium enterprises in the nonmetropolitan areas expressed frustration with the lengthy and complicated paperwork and long waiting period associated with obtaining

Table 5.8 Access to Capital and Finance

	Aratdar	*Wholesale*	*Retail*	*Wholesale and retail*
Average working capital in the past 12 months (BDT, median)	400,000	100,000	25,000	60,000
Share of own funds in current working capital	83	85	85	89
Needed credit in the past 12 months (%)	53.59	45.03	39.10	35.34
Have used credit in the past 12 months (%)	46.96	37.90	35.94	30.17
Number of persons approachable for funding	16	12	13	13
Belong to a savings association (%)	43.09	31.33	29.62	28.45
Average amount drawn from the savings association (BDT)	16,696	9,180	5,308	4,818
Borrowed from bank (%)	7.73	4.23	5.89	7.08
Have an overdraft or cash credit facility (%)	8.29	2.81	0.17	0.86

Source: Shilpi et al. 2015.
Note: *Aratdar* is a wholesale trading service. BDT = Bangladesh taka.

formal loans. While some of the smaller enterprises and microenterprises had access to loans administered by microfinance institutions or nongovernmental organizations (NGOs), those loans seem to be unavailable to traders. For instance, none of the traders in the agricultural value chain surveys reported NGOs or microfinance as sources of credit. The large amount of working capital needed to finance trading, along with traders' perception that poor access to finance and the costs of finance are among the top constraints to business operations, certainly appear to indicate the presence of credit constraints.

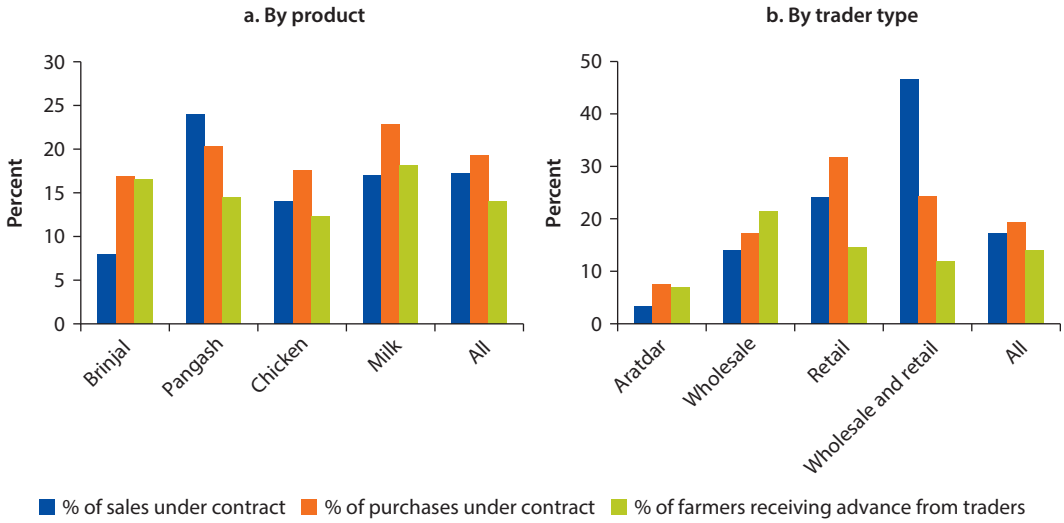
Trade Credit and Advances

The incidence of trader credits and advance payments varies by product in the four value chains studied for this report. The use of contract purchasing and sales is more prevalent among traders operating in the fish and milk markets (figure 5.8, panel a). Nearly one-quarter of sales made by pangash traders and one-fifth of their purchases of pangash involve contracts. The practice of paying advances to farmers is, on the other hand, more common among brinjal and milk traders.

Nearly all sales and purchases at the aratdar level involve payments at the time of delivery—in other words, they are cash sales (figure 5.8, panel b). The use of trade credit increases among downstream traders, however. About one-third of retail traders purchase under contract, and about one-quarter sell under contract. Providing advances to farmers is more prevalent among wholesale traders: 21 percent report providing advance payments.

While aratdars and to some extent wholesalers have better access to bank credit, other traders rely more on contract purchases and sales (table 5.8). Traders' reliance on trust and reputation for conducting business, particularly when that business is based on contracts, is also evident from the purchase and

Figure 5.8 Use of Contracts in Trading



Source: Shilpi et al. 2015.
Note: *Aratdar* is a wholesale trading service; *brinjal* is eggplant; *pangash* is blue catfish.

sales pattern. Most traders rely on regular suppliers (62 percent) and customers (56 percent). The reliance on regular suppliers and customers is much lower at the aratdar level (44 percent and 46 percent, respectively). This reliance on regular customers and suppliers, along with the use of contracts and advance payments, allows wholesale and retail traders who have relatively limited access to formal credit to overcome finance constraints.

Market Behavior: Competition and Efficiency in Trading

As noted, a common perception is that traders' anticompetitive behavior creates distortions in agricultural marketing, especially the marketing of high-value crops. Interestingly, traders operating in supply chains for high-value products seem to share this perception: they rated anticompetitive behavior and informal trading practices as a constraint on their business. It is important, however, to distinguish between traders' concerns about informal trading practices such as "hit-and-run" entry and price cuts, and the anticompetitive behavior that concerns the popular media and policy makers. For policy makers and development practitioners, anticompetitive behavior often implies monopolistic and oligopolistic behavior. To assess whether traders in the surveyed markets behave in a manner contrary to what is expected in a competitive marketplace, several features of competitive markets are examined here. The market surveys indicate that at both the wholesale and retail levels of the marketing chain, numerous traders operate in any given location. For instance, on average more than

40 traders deal with brinjal and pangash in urban markets, and more than 7 traders of the same product operate in rural markets. By the same token, farmers have the choice of selling in multiple markets, giving them the option of taking their produce to alternative markets.

Market Entry Requirements

Traders may be considered to gain market power if entry into a market is difficult. The market survey collected information on the requirements for any trader contemplating starting an operation in a market location (table 5.9). While most markets require traders to have some experience, there is no formal requirement related to education. Most traders need to have proof of identity, licenses to operate in the market, and some guarantees. According to market surveys, it costs about Tk 800 to obtain a license valid for a year in rural markets and Tk 1,000 in urban markets. The time needed to get a license (five to seven days) is not too burdensome. Most of these entry requirements are much less stringent than those observed, for example, in India. The major entry requirement in Bangladesh is a security deposit (Tk 30,000 in rural markets and Tk 70,000 in urban markets). Nearly all shops in a market are rented for a term of three years, and rental deposits are Tk 27,000 in rural markets and Tk 58,000 in urban markets. While the security deposits for renting and operating in a market are quite large, they are relatively small when compared with traders' average working capital requirements. Note that these requirements for entry pertain to large, well-established markets. The financial burden of entering rural primary markets is significantly less, particularly for small and itinerant traders.

Table 5.9 Requirements for Getting a Shop in a Market

Requirement	*Rural*	*Urban*
Experience as a trader (%)	24	30
Years of experience	10	3.6
Years of education	No	No
Security deposit money (%)	24	61
Minimum deposit (BDT)	31,250	70,125
Sales tax registration (%)	6	30
License (%)	65	61
Proof of identity (%)	82	74
Proof of residence (%)	35	35
Creditworthiness or solvency (%)	47	30
Guarantees (%)	59	52
Number of guarantees	1.4	2.5
Any affidavit (%)	47	65

Source: Shilpi et al. 2015.
Note: BDT = Bangladesh taka.

Information and Price Dispersion

An important test of a value chain's competitiveness and geographical integration is whether information about prices is transmitted smoothly up and down the value chain. Price information is critical for the operation of an efficient value chain, as it enables traders to take advantage of arbitrage opportunities. Such arbitrage activities in turn ensure price convergence across areas.

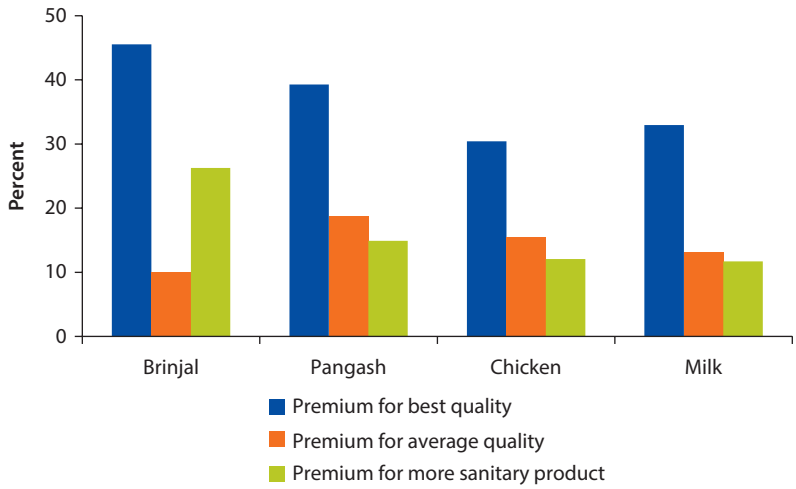
Traders in the survey followed many markets to gather price information. On average traders follow 4.5 input markets, 3 supply markets, and 2.2 sales markets regularly. They consult four to five people in their main market and two to three people in other markets for price information. They reported relying on their own observations in setting prices, although they said they also incorporated feedback from regular customers and other traders. For farmers, the main source of information is other farmers. Chicken and pangash farmers also rely considerably on traders and input suppliers for price information.

To test whether price information is transmitted to the farmers efficiently, the sale price reported (independently) by the surveyed farmers and the purchase price of traders (aratdars and wholesalers) are compared. Despite the farmer and trader surveys being undertaken separately and with some time lag (due to logistics), there is remarkable consistency in the prices reported by these two market actors: sale prices reported by farmers are nearly identical to the purchase prices reported by aratdars and wholesale traders, particularly for brinjal. The difference between what farmers and traders reported is about 7 percent for pangash and 9 percent for milk. Only for chicken is the difference significant. The consistency in the reported price is quite remarkable also because large traders such as aratdars and wholesalers are in most cases located farther from farmers, especially for products like brinjal and chicken, and a significant portion of farmers sampled for these two products came from districts (such as Rangpur) that are far from main urban markets. These findings suggest that information flows from traders to farmers are quite efficient and that the probability of traders having local market power due to farmers' lack of information appears to be quite low in Bangladesh.

Product Quality and Price Premium

While traders use some innovative ways of transporting products to preserve quality (live fish in water-filled drums), few reported having equipment to pack or process products. The relatively low use of technology in trading could result either from some constraints in the availability of infrastructure or services or from a lack of awareness among traders about potential returns to investments in technology. The agricultural value chain survey asked detailed questions about traders' awareness of products' quality attributes as well as the price premium received for better quality products.

Figure 5.9 Quality Premiums by Product



Source: Shilpi et al. 2015.
Note: *Brinjal* is eggplant; *pangash* is blue catfish.

Traders do pay considerable attention to the variety and quality of products that they procure. The survey data indicate that nearly all traders (more than 95 percent) pay attention to quality differences and offer prices accordingly. The price premium for a better quality product is considerable: best quality brinjal fetches nearly 46 percent higher prices than a poor quality product, and even average quality enjoys a 10 percent price premium (figure 5.9). The premium for best quality is 39 percent for pangash, 33 percent for milk, and 30 percent for chicken. The survey data also confirm that farmers are aware of quality and receive higher prices for better quality products.

Traders pay and receive higher prices for products that comply with better health and sanitary requirements. The premium for compliance with health and sanitary standards is 12 percent to 26 percent. Despite the presence of considerable premiums for better quality, however, few traders reported incurring costs to ensure better sanitary standards (8 percent of brinjal, 12 percent of pangash, 11 percent of chicken, and 3 percent of milk traders).

The return from better quality products appears to be much higher than the return from products that comply with health and sanitary standards. Ensuring better quality requires better farming and harvesting practices, better traffic conditions to cut transport delays and losses, better transport equipment (such as refrigerated trucks), adequate cold storage facilities, and reliable electricity supplies. Without better traffic and transport conditions and a reliable electricity supply, it is unlikely to be worthwhile for traders to invest in packing, processing, and transport equipment or for farmers to invest in better farming, harvesting, and processing to enhance and preserve product quality along the supply chain.

Conclusions and Implications

Sustained income growth and rapid urbanization have already translated into higher growth in demand for high-value vegetables, fruits, and animal products such as meat, milk, fish, and eggs in Bangladesh. The expected steep growth in demand for these products domestically and from export markets offers a unique opportunity to raise farmers' and traders' incomes and to generate employment in nonfarm activities. To take advantage of this opportunity, the supply chains for these products have to be geared up to connect farmers to consumers in an efficient way.

Agricultural markets in Bangladesh have been generally favorable to growth. Surveys of traders and farmers confirm that markets function very well overall. Marketing margins are quite small and reasonable, with transport costs being the major source of traders' variable costs. The marketing margins for the most perishable commodities (fish, milk, and chicken) are the lowest. Brinjal costs are higher, largely because of the larger geographical spread of the supply chain. Finally, the surveys of farmers and traders found very little evidence of uncompetitive behavior, including the much-discussed cartelization of markets, in which a few powerful traders collude to fleece farmers.

A second important finding that contradicts a widely held view is that physical postharvest losses are much lower (under 5 percent) than the figure of 30 percent to 40 percent that is routinely quoted. To put the performance of Bangladesh's agricultural markets in perspective, it is useful to compare it with market performance in other countries. Comparable data on the commodities surveyed are limited, but for rice, a recent comparative study of Bangladesh, China, and India shows that the share of the farm-gate price of rice in final retail prices is higher in Bangladesh than in either China or India.

The agricultural value chain surveys conducted for vegetables (brinjal), fish (pangash), chicken, and milk (focusing on the traditional dairy supply chain) find encouraging signs in the production and marketing of these high-value products and provide some valuable insights:

- More educated and younger people are entering into the farming and trading of high-value products, especially fish and poultry. The retention of human capital in the agricultural value chains studied here is a promising sign that the transformation and modernization needed for meeting increased domestic and export demand will be realized.

- Another important strength of agricultural value chains is that farmers appear to have good market access. Farmers typically live within a short distance of at least one primary market and in many instances multiple markets. The close proximity of markets is reflected in farmers' nearly universal propensity to sell in the market instead of at the farm-gate.

- The agricultural value chain is well integrated with respect to different layers (farmers to traders to consumers) and to geographical coverage. As a result,

information about prices flows smoothly and efficiently from traders to consumers. Smooth information flows ensure better prices for farmers and better geographical integration of markets.

- Traders face no serious barriers to entry, not only in primary markets where it is not always necessary to rent a shop but also in the more established markets. The biggest barriers in entering a well-established market are the cost of the security deposit and renting a shop, and perhaps getting an electricity connection. The amount of money needed for a security deposit is not as large as traders' working capital requirement, however. Other than finance, there is no serious barrier to entry, even in large wholesale and retail markets in urban areas.

- As a result, net margins are small for almost all traders, and markets appear to be quite competitive.

Overall, the liberalized marketing environment in Bangladesh appears to serve producers and consumers quite well. This does not mean that there is no room for improvement. The agricultural value chain surveys indicate that several important weaknesses continue to limit performance in the value chains. The main weaknesses of agricultural marketing of high-value products—revealed by objective measures (data on traders' costs and trading practices) and subjective measures (traders' opinions)—include the following:

- **Transport costs.** Traders rate road congestion and transport delays as the most important problems in marketing. Transport costs constitute a large share of trading costs, and transport delays are identified as a major reason for product damage and loss. To counter the lack of refrigerated trucks, fish traders transport live fish in water-filled drums, which unfortunately contributes significantly to trading costs. In addition to raising costs, these difficulties related to transportation cause supply chains (for milk, for example) to be geographically shorter. While Bangladesh has an extensive road network, there is an urgent need to manage traffic conditions and improve trucking fleets to reduce transport delays and their associated costs.

- **Limited access to and cost of finance.** Most traders rated cost of finance as a major or severe problem in operating their business. Trading requires a large investment in terms of working capital, 85 percent of which remains self-financed. Financing by banks remains relatively rare and accessible to only the largest traders (aratdars and wholesalers). Few traders have overdraft facilities. Better access to financial services (such as electronic payment and overdraft facilities) is needed, not only to reduce trading costs but also to ensure that more individuals can enter into trading services.

- **Unreliable electricity supply.** The unreliable power supply tops most of the investment climate assessments in Bangladesh. For traders, the unreliable

power supply means that there is less of an incentive to invest in processing and packing equipment. The survey also indicated an acute and pervasive shortage of cold storage facilities in Bangladesh. Most likely, investments in cold storage are another victim of the unreliable electricity supply.

- **Investment in market facilities.** Marketplaces in Bangladesh provide some facilities—parking, banks, bus stations, and post offices—but they are deficient in the provision of cold storage, mills, warehouses, and equipment such as scales and packing machines. As consumers become more conscious of the quality of the products that they buy, markets will have to conform to higher health and sanitation requirements. The expected expansion in trade of high-value products means that additional investment in market facilities will become essential in the near future.

Annex 5A: Design of the Agricultural Value Chain Surveys

The value chain surveys focused on four products—brinjal, pangash, chicken, and milk—and consisted of separate surveys of traders, markets, and farmers, with an emphasis on trading arrangements for serving domestic markets. The surveys differ from existing value chain studies in several important ways. Rather than just focusing on the estimation of margins, the surveys looked at trading practices, traders' perceptions of constraints, and physical market facilities. The trader, market, and farmer surveys were interlinked to permit the analysis of how a constraint at one layer of the market affected cost and conduct at all other layers. The detailed and interlinked surveys make it possible not only to estimate margins at different layers of the markets but also to analyze the determinants of these margins in terms of infrastructure, facilities, and other policy variables.

World Bank (2008a) provides detailed value chain analyses for several high-value agriculture sectors, including fisheries, poultry, fruits and vegetables, high-value rice, and dairy, and identifies specific policy recommendations for each. That report concentrates on production technology and export potentials, whereas this report investigates the domestic marketing channels, focusing on constraints to the development of an efficient marketing system for perishable products. The four products studied here all figure prominently in the traditional Bangladeshi diet. Brinjal was chosen for the vegetable value chain study because its value chain is similar to those of other widely consumed vegetables (such as tomatoes), and it was in season when the survey was conducted. Among different types of fish, pangash (blue catfish) was selected because it is also widely consumed, especially by the poor.

The survey of trading practices gathered information on credit and other contract arrangements, transportation, damages and losses, sources of information, enforcement of contracts, and security of property. An opinion survey similar to investment climate surveys was used in seeking information from traders on their most important constraints. A separate survey of all major markets gathered information on the specific physical facilities provided at each market. As noted,

the trader, market, and farmer surveys were interlinked to allow analysis of how a constraint at a given layer can affect cost and conduct at all other layers.

The surveys collected information from 1,448 traders (at all layers of the market for each product) from 41 large and a number of smaller markets and 557 farmers for all commodities. The sample of traders is representative at the trader level (wholesale compared to retail compared to other traders) and at the product level. The farmer survey is representative only at the product level. In addition to information on facilities, the market survey collected information on market management, connectivity, and a number of other variables. The sample was drawn in two stages. For each product, the main growing areas were first identified. The sample of main markets was drawn from information on supply points collected through interviews with traders in the main consumption center (Dhaka). For each product, at least two districts were chosen, using two criteria: (a) each is a significant supplier of the product and (b) one district is near the main consumption center (Dhaka) and the other farther away. The survey thus covered seven districts—Narsingdi, Mymensingh, Gazipur, Manikganj, Bogra, Rangpur (one of the poorest and more lagging districts in the country), and Sirajganj. The main growing districts selected for brinjal were Rangpur (6.26 percent of production), Bogra (4.44 percent), and Dhaka (3.6 percent). For chicken, the main growing districts in the sample were Mymensingh (4.12 percent) and Bogra (3.24 percent). For milk, the main areas were Sirajganj (2.23 percent) and Manikganj. For pangash, the main supply areas were Mymensingh (10 percent) and Bogra. Narsingdi and Gazipur, two districts near Dhaka City, are significant suppliers of vegetables, poultry, and milk.

The sample of traders (1,448) was selected randomly from each market from a list of 183 markets. Forty-one of the markets were major wholesale or retail markets and the rest were relatively smaller and of differing sizes, including some rather small primary and village markets that convene once or twice a week. For each of the primary markets surveyed (74), two villages were selected—one near and one far—to draw a random sample of farmers from 148 villages. The market facilities questionnaire was administered in the 41 large wholesale and retail markets.

All of the selected villages are from outside Dhaka City. During the fieldwork, it was discovered that though a village may be far (more than 10 kilometers) from the selected primary market, it may be nearer to another primary market due to the high density of primary markets in Bangladesh. Often primary markets convene only once per week. A farmer may go to several markets in a week. In that way, a number of markets get supplies from a single village on different days of the week. Of the selected villages, 22 were selected to study the brinjal value chain, and 113 farmers from those villages were surveyed randomly; for the chicken value chain, 33 villages were selected and 147 chicken growers surveyed; for the fish value chain, 60 villages and 132 fish farmers; and for the milk value chain, 33 villages and 170 milk producers. No more than 20 respondents were selected from a village, with two exceptions (27 chicken growers from a village in Bogra and 33 milk producers from a village in Sirajganj). As stated, in some

cases it was not possible to select 10 farmers for a given product from each village listed. When this was the case, enumerators interviewed additional farmers from other villages.

Similar to the sample of farmers, no more than 10 traders were selected from a market location, with three exceptions (in Dhaka and Rangpur) where trader density was much higher and traders in the same market location traded a number of the selected products. While markets, traders, villages, and farmers were selected for each of the specific products, it is possible for them to produce or trade more than one of those products. Because of this possibility, there was a chance of some double counting in the final breakdown of the sample with respect to markets, traders, villages, and farmers. The data analysis indicated no such double counting for traders, farmers, and villages. But as already noted, many different types of traders operated in the same market location.

Tables 5A.1–5A.4 provide the detailed sample for the four selected products. Several points should be noted. First, aratdars are not always present in all market locations, particularly for brinjal, chicken, and milk. For brinjal and chicken, aratdars are hardly present in the primary markets and they are more prevalent in the secondary (wholesale) markets. For chicken, aratdars are more like dealers who supply chicks, feed, and medicine to farmers, mostly on credit, and then make sales arrangements with buyers of fully grown chickens. These dealers do not charge any commission but instead get paid from the sales proceeds (the commission is built into the price). Second, there are also beparis in the primary markets (for brinjal) who are classified as wholesalers in the data analysis (for brinjal, for example). Third, the milk market differs from markets for other products in the sense that part of the milk supply goes through the formal marketing channel to processors. Though Sirajganj is a

Table 5A.1 Distribution of Brinjal (Eggplant) Sample

	Narsingdi	*Dhaka*	*Rangpur*	*Gazipur*	***Total***
Farmer	54	0	59	0	**113**
Aratdar (dealer)	7	24	16	2	**49**
Paikar (wholesale)	63	45	71	23	**202**
Retail	46	57	40	3	**146**
Retail and wholesale	6	23	1	0	**30**
Total	**176**	**149**	**187**	**28**	**540**

Table 5A.2 Distribution of Pangash (Fish) Sample

	Mymensingh	*Dhaka*	*Rangpur*	*Bogra*	***Total***
Farmer	71	0	0	61	**132**
Aratdar (dealer)	30	29	21	26	**106**
Paikar (wholesale)	37	28	13	48	**126**
Retail	33	102	15	28	**178**
Retail and wholesale	7	2	1	12	**22**
Total	**178**	**161**	**50**	**175**	**564**

Table 5A.3 Distribution of Chicken Sample

	Gazipur	*Dhaka*	*Rangpur*	*Bogra*	***Total***
Farmer	59	0	24	64	**147**
Aratdar (dealer)	9	24	0	1	**34**
Paikar (wholesale)	45	35	19	55	**154**
Retail	32	74	23	48	**177**
Retail and wholesale	23	36	4	0	**63**
Total	**168**	**169**	**70**	**168**	**575**

Table 5A.4 Distribution of Milk Sample

	Manikganj	*Dhaka*	*Sirajganj*	***Total***
Farmer	56	36	78	**170**
Paikar (wholesale)	21	26	5	**51**
Retail	63	36	0	**99**
Retail and wholesale	2	4	0	**6**
Total	**142**	**102**	**83**	**327**

major milk shed area, few traders engage in the milk trade there as most farmers sell their milk to cooperatives or to agents of large milk processors such as Milk Vita and Aarong.

Notes

1. The share of cereals in per capita calorie consumption declined from 84 percent in 1990 to 80 percent in 2010, and it is expected to decline further to 78 percent by 2020 (Amarasinghe et al. 2014). Consumers are turning more to vegetables, fruits, and other noncereal products, which increased their share of per capita calorie consumption from 12.6 percent in 1990 to 15.8 percent in 2010. Per capita consumption of meat and other animal products is still low in Bangladesh (less than 5 percent of calorie consumption).
2. An advantage was that eggplant was in season at the time of the survey fieldwork.
3. Traders also had the option of responding with "does not apply" if a particular problem was not relevant to them.
4. Detailed cost estimates are given in Shilpi et al. (2015).
5. The access to parking, banking, and other services in these markets in Bangladesh is comparable to that observed in regulated markets in India (World Bank 2008c).

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CHAPTER 6

Prospects for Food and Nutrition Security

Achieving Food and Nutrition Security

Agriculture has played a key role in the development of Bangladesh's economy—improving food security, reducing poverty, and bringing prosperity to areas that have been depressed for a long time. It is still the mainstay for the rural economy, contributing directly and indirectly through significant indirect linkages with the now-ubiquitous nonfarm economy to generate jobs and incomes.

Over the years, the dominant focus of agricultural policy and strategy has been to increase food grain production—principally rice production—to achieve food security. This focus has been successful; Bangladesh is virtually self-sufficient in producing its main staple, rice.[1] Food security, which continues to translate to rice security, still remains the central objective of the government's agricultural strategies. To that end, the focus of policies and public interventions is to maintain the incentives for domestic rice production to expand, specifically through output price support, price stabilization, and fertilizer subsidies. At the same time, government policy is also designed to protect poor consumers through subsidized sales of rice (through the early 1990s) and through important and extensive safety nets involving food for work and food transfers.

Looking ahead, an important question for development strategy and policy concerns the prospects for food and nutrition security should the focus shift toward accelerating income growth. Land is a key factor in agricultural production but is extremely limited in Bangladesh, with little potential for further increases in cropping intensity through irrigation expansion. More than half of rural households are landless, and demographic pressures will likely keep farm sizes low, implying that an increasing number of workers will participate in nonfarm work. At the same time, at the aggregate level food security (in terms of rice) has by and large been achieved. Land productivity has room to improve, given the remaining yield gaps. Demand is rapidly growing for agricultural products other than rice—other crops, livestock, and fisheries—which are a potential source of growth for small landowners. Diversification is important

for the many reasons discussed throughout this report, and for improving nutritional outcomes (which remains a challenge and is discussed in this chapter). Given these different arguments, the future role of agriculture is understandably a source of debate.

To consider the probable future role and direction of change for agriculture, it is important to understand the probable future demand and supply of key food commodities. Hossain and Deb (2011) estimate that by 2021 per capita demand for rice will fall by 1.9 percent in rural areas and 7 percent in urban areas (table 6.1). At the same time, per capita demand for fruit is estimated to rise by 25 percent and 35 percent in rural and urban areas, respectively; for fish by 25 percent and 29 percent, respectively; and for meat and eggs by 39 percent and 29 percent, respectively, assuming that national income grows at 8 percent per year in 2011–16 and 10 percent per year in 2016–21.

To meet these rapidly growing demands, the supply of foods other than rice will need to grow significantly faster than in the past (table 6.2). For example, to meet projected meat and egg demand, supply must grow at an average rate of more than 8 percent per year, yet over the past two decades, the livestock subsector has not grown more rapidly than 5 percent per year. Clearly there is a need to diversify out of rice production in the crops subsector; currently rice occupies nearly 78 percent of gross cropped area.

Bangladesh has made considerable progress in basic nutrition. Average calorie intake is now at 2,318 kilocalories per capita per day relative to the estimated national requirements, based on physical activity and desired body weights, of 2,200 kilocalories per capita per day (Zakir Hussain, Talukder, and Ahmed 2015).[2] Similarly, protein intake—at 66 grams per capita per day in 2010—is now estimated to surpass the recommended level of 58 grams per capita per day (Talukder et al. 2015).

Table 6.1 Projections of Per Capita Consumption for Selected Foods
grams per person per day

	2011		*2021*	
Food category	*Rural*	*Urban*	*Rural*	*Urban*
Rice	530	430	520	400
Wheat	15	30	20	35
Pulses	15	22	19	27
Oils	17	25	20	30
Potato	70	80	80	96
Other vegetables	170	180	200	208
Spices	60	75	70	90
Fruits	40	54	50	73
Sugar	10	15	13	20
Fish	48	62	60	80
Meat and eggs	23	42	32	61
Milk	40	50	50	73

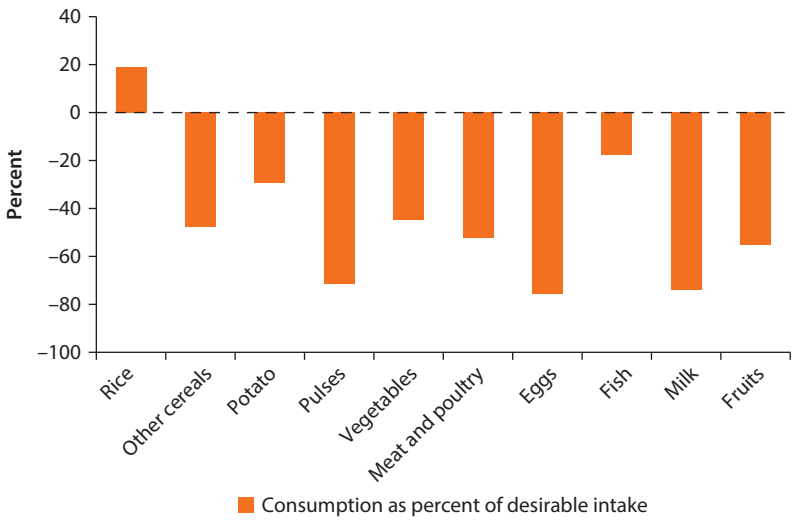
Source: Hossain and Deb 2011.

Table 6.2 Projections in Demand and Expansion in Supply Needed for Selected Foods

	Projected demand (million t)			*Expansion in supply needed (% per year)*	
Food category	*2011*	*2016*	*2021*	*2011–16*	*2016–21*
Rice	27.40	28.71	29.00	1.0	0.2
Wheat	1.02	1.41	1.85	6.5	4.5
Pulses	0.92	1.23	1.56	5.8	4.5
Oils	1.04	1.32	1.72	4.5	4.5
Potato	3.95	4.88	6.00	4.0	3.8
Other vegetables	9.38	11.67	13.64	4.0	3.5
Spices	3.48	4.37	5.85	4.5	4.0
Fruits	2.23	3.27	4.60	6.0	6.0
Sugar	0.62	0.87	1.22	6.0	6.0
Fish	2.81	3.80	5.04	6.3	6.0
Meat and eggs	1.52	2.33	3.28	8.3	6.5
Milk	2.32	3.46	4.86	8.3	6.5

Source: Hossain and Deb 2011.
Note: t = tons (metric).

Figure 6.1 Actual and Desirable Consumption of Selected Foods



Source: Zakir Hussain, Talukder, and Ahmed 2015.

From a nutritional perspective, however, current consumption patterns are far from optimal, with too little dietary diversity. Figure 6.1 illustrates the divergence between current consumption and nutritionally desirable consumption (Zakir Hussain, Talukder, and Ahmed 2015). Rice consumption is already higher than desirable (on average), while other foods are underconsumed.

Given the current consumption pattern and projected demand-supply balance, future food security looks reasonably stable. Uncertainty will of course remain, not least because of climate change (for which the best strategy is to close the current yield gaps).[3] A high priority for agricultural research is to intensify focus on developing food crop varieties that tolerate or resist such stresses as drought, saline soils, and flooding. The Bangladesh Agricultural Research Institute has already made progress in this respect. Intensifying these efforts, complemented by making investments to strengthen agriculture's resilience to climate change, are crucial to secure long-term food security.

The most immediate policy priority, however, is to achieve better nutritional outcomes, since malnutrition rates remain unacceptably high (Zakir Hussain, Talukder, and Ahmed 2015). Intuitively, what happens *to* agriculture matters for sustaining the progress on food security and what happens *in* agriculture matters for promoting nutritional security. The next two sections discuss these two key development challenges.

Agriculture and Nutrition

Bangladesh has made good progress on human development indicators, but malnutrition remains high and has serious human development impacts. Those impacts include very high economic costs in terms of lost productivity, economic activity, and health. Malnutrition is a multisectoral problem: nutritional outcomes are influenced by numerous factors, one of which is agriculture. At first sight, the link between agriculture and nutrition seems obvious: agriculture supplies nutrients because it supplies food, and insufficient calories result in basic undernutrition. But even in sections of the population that have enough food in terms of calories, the scourge of malnutrition (often referred to as "hidden hunger") persists, implying that malnutrition is not just a problem of being too poor to buy food.

A major concern is the lack of diversity in the average individual's and especially the poor person's daily diet. Rice historically has dominated the Bangladeshi diet, at all income levels, and continues to do so. More diverse foods are being consumed, but not in sufficient quantities, as shown in figure 6.1. Even though the links between agriculture and nutrition seem intuitively and conceptually compelling, they have been difficult to demonstrate empirically because suitable data are lacking. Until now, no known dataset provided the three key pieces of information needed for such an analysis: (a) data on households' agricultural production patterns, (b) consumption patterns, and (c) nutritional outcomes (assessed through appropriate anthropometric measures). This shortcoming was overcome recently with a new dataset, the Bangladesh Integrated Household Survey (BIHS) of 2011–12 (IFPRI 2013). This report analyzes these data to investigate the determinants of malnutrition in a nationwide sample of over 5,000 households.

The sample statistics reveal that agricultural patterns, consumption patterns, nutritional intake in terms of calories and proteins, parental health indicators (body mass index [BMI]), and child malnutrition indicators (stunting, wasting,

Table 6.3 BIHS Sample Statistics, 2011–12

Variables	*Sample average*
Total sample (households)	5,503
Rural households (%)	50.3
Farm area (decimals[a])	162.1
Rice area (%)	76.8
Vegetable area (%)	3.6
Fruit area (%)	0.5
Cash crop area (%)	7.4
Farm area diversity (Simpson Diversity Index)	0.11
Calorie diversity (Simpson Diversity Index)	0.45
Mean total assets (BDT)	56,533
Unimproved toilets (households with children under 5) (%)	72.3
Improved toilets (households with children under 5) (%)	27.8
Handwashing (households with children under 5) (%)	51.4
Calorie intake (weekly kcal/household)	16,728
Protein intake (weekly g/household)	512
Average BMI (household head, 98% households reporting)	20.21
Average BMI (spouse, 94% households reporting)	19.25
Wasting (under-5, 43% households with children under 5) (%)	12.3
Stunting (under-5, 43% households with children under 5) (%)	47.1
Underweight (under-5, 43% households with children under 5) (%)	33.6

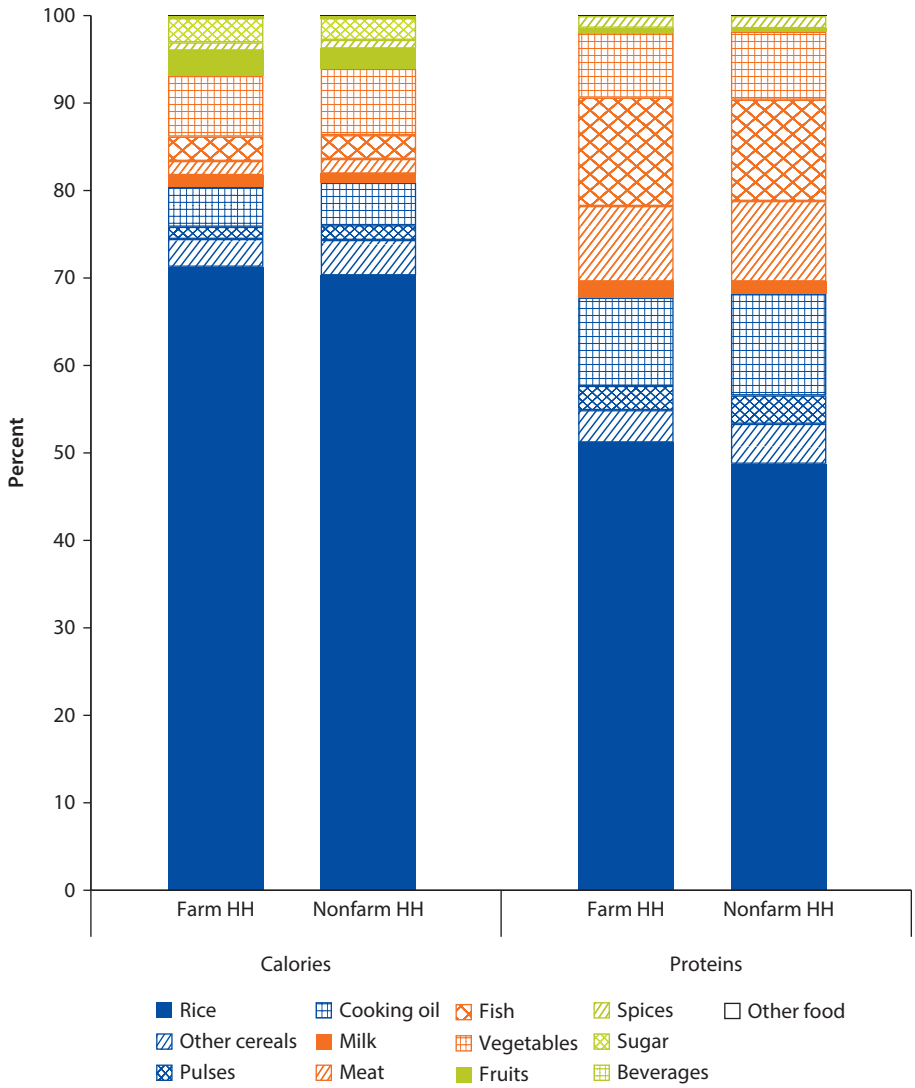
Source: BIHS 2011–12.
Note: BDT = Bangladesh taka; BMI = body mass index; g = grams; kcal = kilocalories.
a. A decimal is a unit of measurement for land in Bangladesh. 100 decimals = 1 acre, and 247.158 decimals = 1 hectare.

and underweight z-scores calculated according to the formulas of the World Health Organization) are similar to national averages based on multiple appropriate sources (table 6.3). Detailed shares of food expenditure by major food group and income quintile are given in annex 6A, table 6A.1.

Cereals dominate household food expenditures at 41 percent, with the next highest share of expenditures being on vegetables and fruits (16 percent) and fish (12 percent). Pulses and meats (including poultry) are about 8 percent each. The expenditure pattern seems reasonably diversified, but the relative price differentials are substantial, and when these shares are converted into physical terms (major nutrients, in calories and proteins), the dominance and overconsumption of rice are evident (figure 6.2). Importantly, while the share of cereals (primarily rice) falls in terms of expenditures as incomes rise, the shares of calories and protein sourced from rice continue to rise!

Expenditure shares of other commodities show some predictable patterns but also some unpredictable ones. Animal products and fish rise with incomes, but the shares of other food groups remain about the same, including (somewhat surprisingly) vegetables. Part of the reason is that the average diet, even at lower income levels, has a reasonably high level of consumption of vegetables, which may reflect widespread homestead and kitchen gardening (even among the functionally landless who have some homestead land).

Figure 6.2 Share of Foods in Calorie and Protein Intake



Source: BIHS 2011–12.
Note: HH = household.

Before turning to the determinants of nutritional outcomes, it is important to highlight the impact of policies on consumption choices. Estimates from a consumer demand system for the major commodity groups (see annex 6A, table 6A.2) show the predictable declining expenditure (a proxy for income) elasticity for cereals, and cooking oil and spices, but proteins and vegetables and fruits are highly income elastic—a different trend from the descriptive analysis of expenditure shares. Clearly other factors are important, highlighting potential drawbacks of descriptive analysis. More relevant for policy are the net household consumption responses to prices (see table 6A.3 in annex 6A). All foods show

expected own and cross-price responsiveness, but the results clearly show a much larger negative impact of high prices on the demand for protein and vegetables and fruits. Given that the cross-price elasticities are relatively small, it seems households' major response may be to cut back on those foods and partly substitute other foods for them, mainly cereals and spices. The nutritional impact of price policies that alter relative prices, especially in favor of cereals, is thus potentially significant.

The impact of economic policies on the demand for calories and proteins through prices is significant. Controlling for demographic (negative) and income (positive) impacts, Gautam and Chellaraj (2016) show that higher cereal prices significantly reduce calorie intake of the poorest two quintiles, while pulse, cooking oil, and spice prices increase calorie consumption across the board, showing strong substitution effects. Higher vegetable prices also force the poorest two quintiles into higher calorie consumption. In terms of the price effects on proteins, the results confirm the converse of the calorie impacts: higher cereal prices promote protein consumption, as do higher vegetable prices, for all groups except the top quintile. Higher protein prices negatively impact protein consumption only for the bottom two quintiles. The results strongly suggest that price movements have particularly strong impacts on the poor.

The more direct agriculture-nutrition pathway is demonstrated through three interlinked relationships. One is the relationship between agricultural production diversity (used to capture the impact of what is done in agriculture, beyond the obvious income effects through higher productivity) and dietary diversity (measured as Simpson Diversity Index of calorie consumption from different sources of food). The second is the subsequent impact of dietary diversity on nutritional outcomes, for which the parental (household head and spouse) BMI is used as a proxy. And finally, to close the link to child malnutrition, the third relationship is the impact of parental BMI (along with the direct impact of dietary diversity) on the nutritional indicators for children under five years of age.

Nutritional outcomes are likely to be an outcome of multiple factors; therefore it is not clear how important or relevant each of these may be. To address this concern—in addition to the usual demographic variables—the estimations control for the following potentially important factors in explaining nutritional outcomes to provide a more robust confirmation of the agriculture-nutrition linkages:

- **Household income** (using total expenditures per capita as a proxy for permanent income as is standard in consumption and poverty analyses) and **wealth**—to control for the income effect
- **Shares of farm income**—in addition to total household income—to capture any specific impact that agricultural incomes may have as distinct from income from other sources, or from cropping patterns captured by the **diversification index**
- **Rice and other food prices** (as indices), which capture a broad range of economic factors, including direct and indirect impact of policies

- **Distances to markets and public facilities**, which capture infrastructure and public service access
- **Type of toilet**, which controls for sanitation and hygiene, an important potential determinant of malnutrition
- A **water, sanitation, and hygiene (WASH) indicator**, for households reporting knowledge of the importance of washing hands after using toilets, after cleaning a child who has defecated, and before eating food or feeding a child.

The main results for the three relationships (production-dietary diversity; dietary diversity-BMI; and determinants of child malnutrition) are shown in annex 6A, tables 6A.4 and 6A.5. The determinants of dietary diversity and BMI for both household heads and spouses for all households in the dataset are provided in table 6A.4.[4] The main points emerging from the dietary diversity and BMI analysis are:

- Farm production diversity, captured as an index of the area allocated to different crops, shows a significant nonlinear relationship with dietary diversity. At very low levels, farm diversification reduces dietary diversity, but beyond a threshold, diversification has a strong positive influence on dietary diversity. This result establishes the role of diversification beyond the "income and wealth effects" captured by the relevant variables. The relationship is robust for both head of household and spouse of head of household and across all specifications tried.

- This result needs to be interpreted carefully, however. As constructed, the production diversity index does not indicate the type of crops grown. Almost one-third of the sample is completely specialized in a single crop (that is, there is no diversification, with the index taking the value of zero), but this single-cropped area is not all under rice. A breakdown of the sample by decile of the diversification index shows that the lowest decile (no diversification) group has the lowest average share of area under rice. A breakdown by decile of farm area also shows that the lowest decile households have the higher share of area under other crops (primarily vegetables, spices, potatoes, and a generic category of "cash crops").

- A related robustness check to verify this conclusion statistically is to test for the impact of the area allocated to rice on dietary diversity. All results (not shown here) show a significant negative impact of rice area on dietary diversity, confirming that diversification out of rice is a priority for nutritional outcomes.

- Total assets, consumption expenditures per capita (a proxy for income), and food expenditures per capita all have strong positive impacts on dietary diversity, as expected. Farming households show lower dietary diversity—not surprising, since many produce their own food—and the high concentration of area

under rice has a strong influence on diets. Consistent with the income effects are the significant positive impacts of both domestic and international remittances.

- Other key policy variables are prices. High rice prices promote dietary diversity, while high prices for other foods reduce it. Again this result is not a surprise, but it reinforces the point that agricultural price policy has a widespread impact on nutritional outcomes.

- The education level of women, at the secondary level, has a positive impact, as does a secondary-level education of the household head (although at a weaker level of significance).

- An important variable is own fish farming. The indicator shows a significant positive impact, indicating the potential importance of fish culture on dietary and nutritional outcomes.

- Turning now to the impact of dietary diversity on adult BMI, the results show a sharp difference between the impact for household head and spouses. Household heads or males show a strong and significant positive impact of dietary diversity, but they seem to be getting sufficient calories, since the indicator for calorie sufficiency is not significant. The results are the opposite for women. Dietary diversity is insignificant, but the indicator for calorie sufficiency is highly significant, implying that insufficient calorie intake is the primary problem facing women in determining their BMI. Once women meet their calorie requirements, their dietary diversity may become significant, but that is only a conjecture now.

- Among the other determinants of adult nutritional outcomes (BMI), assets and total expenditure per capita (income) have a positive and significant influence.

- Among the nonagricultural determinants, improved toilet use is strongly and positively related to higher BMI, highlighting the importance of sanitation.

- Education levels matter for both heads and spouses. But interestingly as men get older they have lower BMIs, while women tend to have higher BMIs as they get older.

- Women's empowerment also has interesting results. Women working outside the home have a negative impact on heads' BMI but a positive impact on spouses' BMI.

In addition to confirming the relationships between agriculture, dietary diversity, and adult nutritional status, an important advantage of the BIHS is the information on the three key indicators of child (under-5) malnutrition. The main points from the estimation of these relationships, given in annex 6A, table 6A.5, are as follows:

- Both adults' BMI has a strong, significant, and consistently negative impact on child malnutrition. For both parents, higher BMIs significantly reduce the probability of the child being stunted, wasted, or being underweight. Direct area or agricultural production diversification has no influence, indicating that the main channel through which agriculture links to a child's malnutrition is through the parents' health status.
- The results also confirm the multisectoral nature of the malnutrition problem: WASH has a significant negative impact on stunting, but not on wasting or being underweight. Improved toilets reduce children's stunting and underweight status.
- The impact of total household expenditure per capita (incomes) is significant and negative, confirming that income effects too matter. International remittances matter for wasting and underweight but are not significant for stunting.
- Mother's education matters (at different levels) for the different outcome indicators.

Overall the results show strong links between agricultural diversification and nutritional outcomes, a dimension that has often not been featured enough in agricultural policy decision making.

Strategies for Food Security and Shared Prosperity: A Scenario Analysis

Food and nutrition security remain high priorities in the development strategy of Bangladesh, but so do poverty reduction and shared prosperity. It is important to assess the complementarities and trade-offs implied by alternative development strategies with respect to these policy goals. Similar aggregate growth can be achieved through development strategies that focus on specific sectors, and within sectors on specific subsectors, each with differing implications for food and nutrition security. To understand the relative merits of the different possible strategies, a scenario analysis is undertaken using a dynamic computable general equilibrium (CGE) model for the Bangladesh economy. The CGE model uses the latest available Social Accounting Matrix (SAM) for 2007, updated to 2015. This approach allows for an examination of how real gross domestic product (GDP) per capita growth rates and various measures of food consumption and demand change over time under a range of possible future scenarios. A brief description of the CGE model is given in annex 6A, and the full description of the model and detailed results are in Ahmed, Gautam, and Raihan (2015).

The first scenario establishes the baseline with the total factor productivity (TFP) for each sector growing at an average annual rate of 2 percent until 2030.[5] In addition, counterfactual scenarios simulate TFP growth rate increases in individual sectors, representing strategies and policy interventions focused on specific (selected) sectors. At the broad sector level, the scenarios correspond to increases

in TFP for agriculture, manufacturing, and services, along with a balanced scenario in which all sectors receive the same treatment. Within agriculture, strategic trade-offs are considered by focusing on specific subsectors: rice, nonrice crops and forestry, livestock and poultry, and fisheries. In each of these scenarios, the TFP is accelerated by 3 percent to reflect the impact of a set of policies and interventions specifically focused on individual subsectors.

The eight counterfactual scenarios maintain the baseline TFP growth rates in all sectors. They differ in the following respects:

1. **Rice-only acceleration.** Accelerate TFP growth rate of paddy and milling by 3 percent.
2. **Nonrice crops and forestry only acceleration.** Accelerate TFP growth rate of all crops and forestry, other than paddy and milling, by 3 percent.
3. **Livestock and poultry only acceleration.** Accelerate TFP growth rate of livestock and poultry by 3 percent.
4. **Fisheries-only acceleration.** Accelerate TFP growth rate of fisheries by 3 percent.
5. **Agricultural acceleration.** Accelerate TFP growth rate of all agricultural subsectors by 3 percent.
6. **Manufacturing acceleration.** Accelerate TFP growth rate of the manufacturing sectors by 3 percent.
7. **Services acceleration.** Accelerate TFP growth rate of the services sectors by 3 percent.
8. **Balanced acceleration.** Accelerate the TFP growth rate of all sectors by 3 percent.

In addition to those eight scenarios, four variants of the balanced acceleration scenario consider accelerating the nonagricultural sectors but only selectively focus on each of the four agricultural subsectors (similar to scenarios 1–4). The impact of alternative strategies in terms of the incremental GDP generated under each sector strategy scenario is summarized in figure 6.3. The height of the bars represents the percentage difference in the aggregate GDP projected for 2030 for each scenario relative to the baseline outcomes.

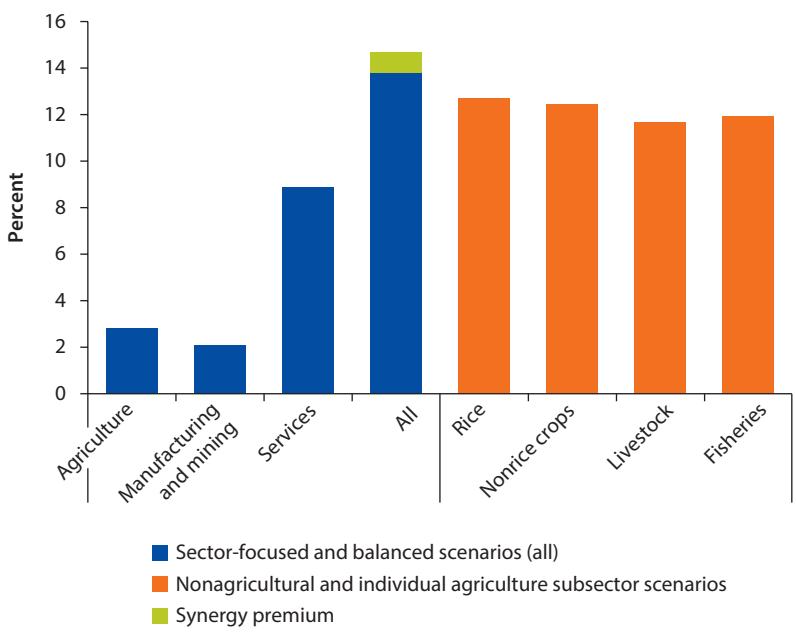
In terms of aggregate growth, as intuition would suggest, the balanced growth strategy gives Bangladesh the fastest average annual per capita real GDP growth rate in the 2015–30 period, as shown by the highest incremental gains relative to any single-sector strategy. Given the size of the sectors (the share of agriculture in GDP in the SAM is 23 percent, manufacturing is 13 percent, and services is 63 percent), the absolute gains in total GDP from a TFP shock of similar magnitude will always produce higher growth from the "larger" sectors. Clearly, agriculture alone is not a viable strategy to promote rapid aggregate growth. An equally important message from the simulation results in figure 6.3 is that a balanced strategy is significantly superior to any single-sector strategy, irrespective of the size of any sector (in the case of Bangladesh, the largest sector is services). A balanced strategy creates a synergy premium of almost

1 percent, more than a simple sum of the "parts" (that is, individual sector strategies) would indicate.

The same synergistic effect is observed when considering individual agricultural subsector scenarios. Figure 6.3 shows the simulation outcomes for scenarios with nonagricultural sectors all growing at an accelerated pace, but within agriculture the strategy is selectively applied to individual subsectors (rice, nonrice crops and forestry, livestock and poultry, and fisheries). All narrowly focused subsector strategies perform poorly relative to a balanced agricultural sector strategy. Again, the scale effect is visible, with the rice scenario having the highest aggregate impact on growth, reflecting the dominance of rice in Bangladeshi agriculture. Importantly, the nonrice crops and forestry scenario shows almost the same impact, clearly indicating that diversification out of rice is not likely to compromise growth as may be feared. Additionally it could improve the much-desired nutritional outcomes with an increase in more nutritious nonrice crops.

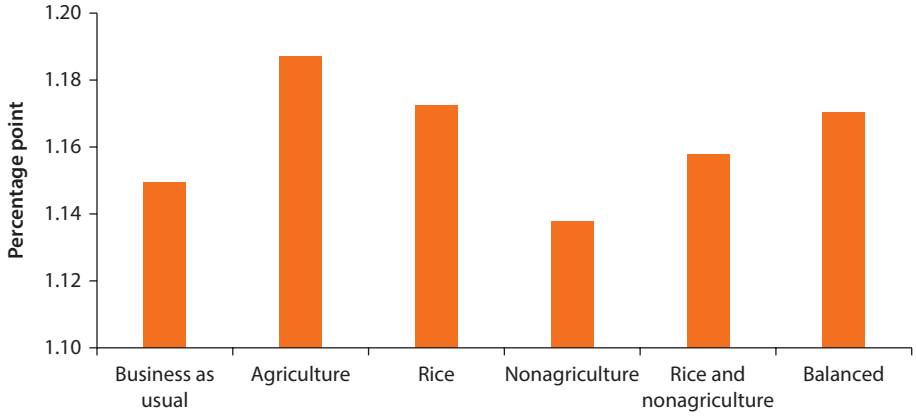
The simulation results provide insights into the pro-poor nature of alternative growth strategies, and the likely implications of alternative strategies for food security and nutrition. Agricultural growth has the highest elasticity of both total and food consumption by households relative to growth originating in the nonagricultural part of the economy (figures 6.4 and 6.5). Within agriculture, productivity growth in rice has the largest impacts on total household consumption, given the dominant share of rice in the food basket (in terms of calories and expenditures).

Figure 6.3 Incremental GDP Gains from Alternative Scenarios in 2030 Relative to the Baseline



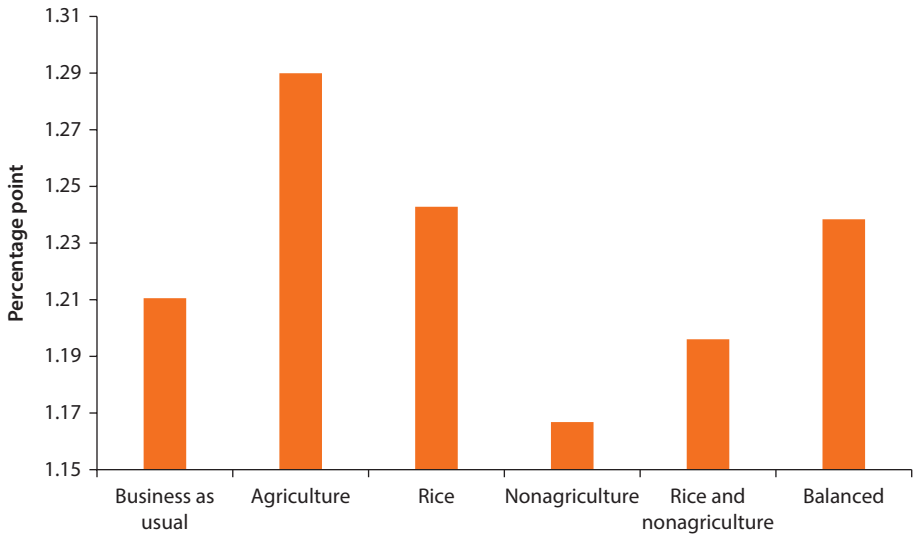
Source: Simulation results.

Figure 6.4 Real GDP Elasticity of Household Total Consumption Growth under Different Scenarios, 2015–30



Source: Simulation results.
Note: For a given scenario, the elasticity is determined by dividing the average annual consumption growth rate by the average annual real GDP growth rate. The nonrice crops and forestry, livestock and poultry, and fisheries acceleration scenarios have similar elasticities of 1.15–1.16.

Figure 6.5 Real GDP Elasticity of Household Food Consumption Growth under Different Scenarios, 2015–30



Source: Simulation results.
Note: For a given scenario, the elasticity is determined by dividing the average annual consumption growth rate by the average annual real GDP growth rate. The nonrice crops and forestry, livestock and poultry, and fisheries acceleration scenarios have similar elasticities of 1.22–1.23.

These patterns are explained by two factors. First, agricultural strategies lead to lower food prices with positive impacts on welfare economywide. Increased supplies (with falling demand in the case of rice, given the negative income elasticity of rice) result in food prices falling, which especially benefits the poor. Second, improved productivity also helps to release factors (particularly labor)

from agriculture, with positive ripple effects throughout the economy through factor markets. Within agriculture, higher rice productivity also pushes factors into other agricultural commodities, leading to relatively smaller price declines even for nonrice crops.

From a food and nutritional security perspective, the simulations have important implications for development strategy. Agriculture-focused strategies lead to faster consumption growth than nonagriculture strategies (see table 6.4). Within agriculture, a focus primarily on rice does not help as much with dietary diversity (in the form of demand and consumption of nonrice foods) as do policies and strategies that promote diversification out of rice. The significant incremental impact on consumption patterns—with significant implications for nutritional outcomes—from a diversified agriculture and balanced overall growth strategy is more clearly brought out in figure 6.6.

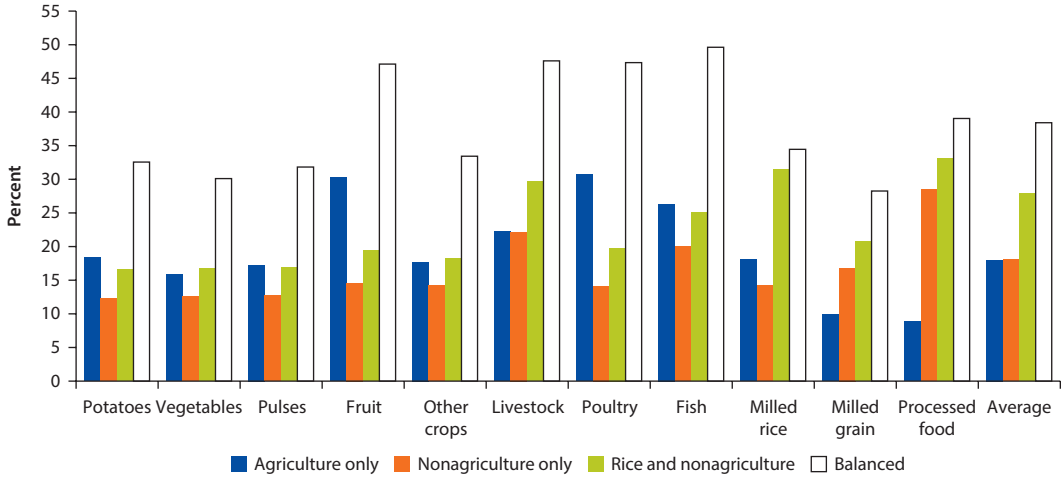
Food security traditionally defined in terms of rice consumption is not compromised by adopting a more diversified agriculture and balanced strategy (compared to the rice-only with nonagricultural growth strategy). At the same time, the consumption of more diverse, nutrient-rich foods shows a massive increase. The gains are significantly higher than even with an agriculture-only strategy, indicating that nonagricultural growth, along with agricultural growth, needs to be a priority for promoting nutritional outcomes. These trends reflect the trends in prices for various foods, leading to important shifts in the demand for nonrice and more nutrient-rich foods (see annex 6A, tables 6A.1, 6A.2, and 6A.3). The outcomes from (a) nonagricultural sector acceleration alone and (b) nonagricultural sector acceleration

Table 6.4 Simulated Average Annual Growth in Household Food Consumption, 2015–30
percent

Food category	*Baseline*	*Agriculture*	*Rice*	*Nonrice crops*	*Livestock*	*Fisheries*	*Nonagriculture*	*Rice and nonagriculture*	*Balanced*
Potatoes	4.8	5.5	5.0	5.3	4.9	4.9	5.3	5.4	5.9
Vegetables	4.7	5.3	4.9	5.1	4.8	4.7	5.1	5.3	5.7
Pulses	4.8	5.4	4.9	5.2	4.8	4.8	5.2	5.4	5.8
Fruit	5.9	6.7	6.0	6.6	5.9	5.9	6.3	6.4	7.2
Other crops	5.1	5.6	5.2	5.5	5.1	5.1	5.5	5.7	6.1
Livestock	5.9	6.5	6.1	6.0	6.2	5.9	6.5	6.7	7.2
Poultry	5.9	6.8	6.0	6.1	6.4	5.9	6.3	6.5	7.2
Fish	6.0	6.7	6.1	6.0	6.0	6.5	6.6	6.7	7.3
Milled rice	5.0	5.6	5.5	5.0	5.0	5.0	5.5	6.0	6.1
Milled grain	4.7	5.0	4.8	4.8	4.7	4.7	5.2	5.4	5.6
Processed food	5.4	5.7	5.5	5.5	5.4	5.4	6.3	6.4	6.6
Average	*5.3*	*5.9*	*5.6*	*5.4*	*5.4*	*5.4*	*5.9*	*6.1*	*6.4*

Source: Simulation results.
Note: The average is the weighted average.

Figure 6.6 Incremental Changes in Consumption of Various Foods Relative to Baseline under Alternative Growth Scenarios



Source: Simulation results.

along with continuing rice productivity improvements result in predictable impacts, highlighting the need to focus on agriculture, with a shift toward nonrice food sectors.

Conclusions and Implications

Prospects for agricultural growth are closely linked to prospects for food security and nutrition. At this juncture of Bangladesh's agricultural transformation, policy makers and other stakeholders must consider what might happen to food and nutrition security if the focus of development policy and strategy shifts more toward diversification, with an emphasis on income growth.

Fortunately the trade-off appears to be less of an issue now than in the past, when self-sufficiency in rice was the overarching imperative. Projections indicate that the future supply of rice relative to demand is unlikely to be a major concern, and that the supply of other food groups needs to grow significantly faster than in the past. The scope for improving yields is substantial given current yield gaps, especially for *aman* and *aus* rice. With a continued focus on agricultural research to push the production frontier forward and to build agriculture's resilience to climate and biophysical stress, there is significant potential to release land for much-needed crop diversification.

A more immediate policy priority is to achieve better nutritional outcomes. Malnutrition rates remain high and have serious human development and economic impacts. It can be argued that what happens *to* agriculture is important to sustaining food security, and what happens *in* agriculture matters for improving nutritional outcomes. Clearly, nutritional security is a complex, multisectoral challenge, with many contributory factors, among which agriculture is

prominent. At the same time, however, researchers and others must develop deeper understandings of how agriculture influences nutritional outcomes.

Bangladesh lacks sufficient dietary diversity in the average person's (and especially the poor person's) daily consumption, which is often traced back to agricultural diversification: the availability of a diverse range of affordable food. These concerns are validated by demonstrating three links along the agriculture-nutrition causal chain (pathway). One is the relationship between diversity in agricultural production and diversity in diets (measured as Simpson Diversity Index of calorie consumption from different sources of foods). Given the high percentage of rural households that farm and consume a significant share of their own production, the hypothesis is that production patterns matter for consumption patterns. The second link is the subsequent impact of dietary diversity on household nutritional outcomes. For adults, the key outcome assessed is the impact of dietary diversity on parental BMI (with the household head presumed to be the father and the spouse presumed to be the mother for most households). For children, the major nutritional outcomes are the standard anthropometric indictors for under-5 stunting, wasting, and being underweight. To close the link between agriculture and child malnutrition, the third link considered is the impact of parental BMI (along with the direct impact of dietary diversity) on the child nutritional outcome indicators.

The analysis confirms the presumed positive impacts of income (and wealth) on dietary diversity. Beyond this "income effect," the multisectoral nature of the nutrition problem is highlighted by the impact of sanitation (particularly the prevalence of improved toilets) on nutritional outcomes of both adults and children under 5 (for stunting and being underweight but not for wasting). Women's education and empowerment (captured as women in the household working outside of the home) also significantly improve women's nutritional status.

In addition to these factors, agriculture has an important role in improved nutritional outcomes. The first link in this causal chain is through consumption diversity. This influence works through three channels. First, the overall policy framework is critical, since it affects the relative prices of different foods. As predicted by standard microeconomic theory, higher rice prices increase dietary diversity and higher nonrice prices reduce it. Second, higher agricultural (production) diversification has a strong positive effect on consumption diversity. Third, own fish production has a positive impact on consumption diversity (although the same cannot be said for livestock production).

The second link in the chain is between agriculture and adult nutrition (using BMI as a proxy), but in this case the impact differs for men and women (household head and spouse, respectively). Men's BMI is affected significantly positively through dietary diversity (household calorie consumption per capita is not significant). Female BMI, however, is responsive to the index of calorie intake but not to dietary diversity, suggesting that for women, overcoming basic calorie deficiency (or hunger) seems to be a more immediate problem. Once it is addressed, perhaps dietary diversity would become as important a factor as for men.

Finally, the results on children's nutritional outcomes establish that the main channel through which agriculture affects under-5 malnutrition is through the parental BMI. Both parents' BMIs have strong impacts in reducing wasting, stunting, and being underweight. The direct impact of production diversity is not found to be significant. Household dietary diversity directly affects only children's underweight problem, but the statistical impact is weakly significant. Higher incomes reduce the probability of all three problems, as expected. Sanitation is also a factor in children's stunting and being underweight but not for wasting.

The scenario analysis using a general equilibrium model confirms that a diversified agricultural strategy is more beneficial for improving nutritional outcomes. Among single-sector strategies, an exclusive nonagricultural focus would generate higher aggregate growth, which is to be expected given the relative size of agriculture in the overall economy. However, the analysis also shows that a balanced strategy is far superior to any individual sector strategy, with the added bonus of a synergistic premium (that is, growth in excess of the sum of individual sector strategies) equivalent to almost 7 percent additional GDP growth.

In terms of the pro-poor nature of alternative strategies, the results show agricultural growth to have the highest elasticity of both total and food consumption by households relative to growth originating in the nonagricultural parts of the economy. A balanced strategy (one that simultaneously pursues agricultural and nonagricultural growth) would result in elasticities that are similar to those of the agriculture-focused approaches, while yielding substantially higher GDP growth. The balanced strategy also provides higher elasticities of total and food consumption than any nonagriculture-focused strategy alone. Within agriculture, productivity growth in rice has the largest impact on total household consumption by lowering rice prices, given the dominant share of rice in the food basket (in terms of calories and expenditures). Therefore rice productivity is key to sustaining food security and economywide real welfare gains through lower food prices. For promoting dietary diversity (the consumption of nonrice foods), and by association nutritional outcomes, a balanced strategy with an agriculture strategy that pursues both rice and the nutrient-dense nonrice crops, livestock, and fisheries does significantly better.

The main implications of the analysis are as follows:

- Promoting agricultural diversification will strongly influence nutritional outcomes and needs to be at the center of the agricultural development strategy going forward. The situation with respect to food security, specifically in terms of rice, is reasonably comfortable and can be maintained through improved productivity of aman and aus rice. Increased aman production, in which Bangladesh has a comparative advantage, will help release land from *boro* rice for more nutrient-rich crops, especially horticulture. Removing policy and institutional distortions that affect relative prices of food commodities and constrain farmers' decisions on diversification are a high priority for better nutritional outcomes, along with improved sanitation.

- Bangladesh has a good track record on progress in women's empowerment. The striking result that women's BMI is affected more by increased calories per capita instead of dietary diversity suggests the presence of a more basic undernutrition challenge for women (owing to insufficient calorie intake) and calls for a redoubling of efforts to overcome the remaining problems of women's hunger, health, and empowerment.

- The simulation results clearly show that food security traditionally defined in terms of rice consumption is not compromised by adopting a more diversified agriculture and balanced strategy (compared to an exclusive focus on rice, with or without a simultaneous focus on a nonagricultural growth strategy).

- Finally, the general equilibrium scenario analysis clearly demonstrates the superiority of a balanced strategy for more pro-poor growth, food security, and better nutritional outcomes. In other words, for faster poverty reduction and shared prosperity, pursuing a broad-based agricultural growth strategy needs to be a priority along with promoting nonagricultural growth.

Annex 6A: Detailed Results on Agriculture-Nutrition Linkages and the Scenario Analysis Model

Selected Results

Table 6A.1 Share of Food Expenditure by Food Group and Income Quintile, 2011–12

percent

Food expenditure category	*Aggregate*	*Income quintile*				
		First	*Second*	*Third*	*Fourth*	*Fifth*
Cereals	40.7	45.6	42.6	42.3	39.1	34.1
Pulses and cooking oil	8.3	8.5	8.3	8.3	8.3	8.2
Vegetables and fruits	16.4	16.5	15.7	16.1	16.4	17.2
Milk and meat	7.8	4.7	6.9	7.4	8.5	11.7
Fish	12.1	10.7	12.1	11.3	12.6	13.7
Spices and beverages	5.0	5.5	5.1	4.9	4.9	4.6
Sugar and other	9.7	8.5	9.4	9.7	10.2	10.6

Source: BIHS 2011–12.

Table 6A.2 Expenditure and Uncompensated Price Elasticity of Food Demand, 2011–12

Commodity group	*Expenditure*	*Cereals*	*Cooking oil*	*Protein*	*Vegetables and fruits*	*Spices*	*Beverages, sugar, others*
Cereals	0.487	–0.807	0.175	0.104	0.079	0.023	0.077
Cooking oil	0.633	0.061	–0.658	0.014	–0.004	–0.108	–0.004
Protein	1.764	–0.323	–0.269	–1.140	–0.134	–0.033	–0.079
Vegetables and fruits	1.168	–0.080	–0.102	–0.048	–0.996	–0.014	–0.007
Spices	0.740	0.102	0.081	0.072	0.023	–0.247	–0.101
Beverages, sugar, others	1.280	–0.014	–0.486	–0.063	–0.030	–0.096	–1.121

Source: BIHS 2001–12.
Note: Elasticities estimated from an Almost Ideal Demand System specification.

Table 6A.3 Compensated Price Elasticity of Food Demand, 2011–12

Commodity group	*Cereals*	*Cooking oil*	*Protein*	*Vegetables and fruits*	*Spices*	*Beverages, sugar, others*
Cereals	−0.557	0.942	0.204	0.152	0.038	0.202
Cooking oil	0.410	−0.655	0.214	0.155	−0.111	0.092
Protein	0.401	−0.066	−0.803	0.152	0.060	0.100
Vegetables and fruits	0.403	−0.163	0.208	−0.814	0.025	0.118
Spices	0.406	0.111	0.219	0.156	−0.239	0.043
Beverages, sugar, others	0.432	−0.659	0.216	0.174	−0.129	−1.009

Source: BIHS 2011–12.
Note: Elasticities estimated from an Almost Ideal Demand System specification.

Table 6A.4 Determinants of Dietary Diversity and Body Mass Index (BMI), 2011–12

Regressors	*Dietary diversity*	*HH BMI*	*Dietary diversity*	*Spouse BMI*
Agricultural diversification	−0.281***		−0.290***	
	(−3.43)		(−3.51)	
Agricultural diversification squared	0.529***		0.539***	
	(4.15)		(4.21)	
Dietary diversity (log)		1.577***		−0.159
		(4.06)		(−0.37)
Total calories per capita (log)		−0.065		0.475**
		(−0.39)		(2.29)
Household assets (log)	0.026***	0.319***	0.029***	0.363***
	(7.00)	(8.35)	(7.66)	(7.94)
Domestic remittances per capita (log)	0.001***		0.001***	
	(3.73)		(3.19)	
Foreign remittances per capita (log)	0.002***		0.001***	
	(4.05)		(2.53)	
Rice price (log)	0.018***		0.014**	
	(2.64)		(2.15)	
Other food price (log)	−0.305***		−0.311***	
	(−22.86)		(−23.14)	
Food expenditures per capita	0.130***		0.036***	
	(8.62)		(14.24)	
Total expenditures per capita	0.222***	0.148**	0.191***	0.441***
	(22.41)	(2.03)	(17.97)	(2.76)
Farming household (binary)	−0.045***		−0.034***	
	(−3.31)		(−2.49)	
Distance to market (log)	−0.001		−0.001	
	(−1.44)		(−1.25)	
Distance to public health facilities (log)		−0.007		−0.009
		(−1.44)		(−1.25)
Prevalence of community toilets (village share)		8.20		−10.988*
		(1.06)		(−1.67)
Prevalence of improved toilets (village share)		7.853***		0.732**
		(4.12)		(2.05)
Household size (log)	0.167***	0.354***	0.517***	0.414**
	(5.16)	(2.68)	(11.70)	(2.49)
Marital status (married = 1)	0.052***	0.327**	0.052***	0.526***
	(3.44)	(2.12)	(3.25)	(2.70)

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Table 6A.4 Determinants of Dietary Diversity and Body Mass Index (BMI), 2011–12 *(continued)*

Regressors	*Dietary diversity*	*HH BMI*	*Dietary diversity*	*Spouse BMI*
Religion (Muslim = 1, binary)	−0.071***	0.333***	−0.065***	0.003
	(−5.53)	(2.50)	(−5.14)	(0.02)
Language (Bengali = 1, binary)	0.232***	−1.402	0.186***	−0.513
	(2.69)	(−1.56)	(2.27)	(−0.51)
Ethnicity (Bengali = 1, binary)	−0.066	0.792	−0.043	1.091
	(−0.81)	(0.93)	(−0.55)	(1.12)
Literacy of HH head (binary)	0.038***	0.420***	0.038***	−0.236
	(3.45)	(3.63)	(3.38)	(−1.53)
Age of HH head (years, log)	0.019	−0.365***	0.016	1.139***
	(1.30)	(−2.56)	(1.04)	(6.51)
HH head education: primary (binary)	0.003	0.205*	0.070	−0.241*
	(0.25)	(1.81)	(0.63)	(−1.78)
HH head education: secondary (binary)	0.009*	−0.029	0.007	0.166**
	(1.67)	(−0.50)	(1.11)	(2.43)
HH head education: tertiary (binary)	0.021	0.125	0.021	−0.393*
	(1.48)	(1.28)	(1.42)	(−2.27)
Spouse education: primary (binary)	0.019	−0.757***	0.007	2.581***
	(1.20)	(−4.78)	(0.41)	(12.57)
Spouse education: secondary (binary)	0.063***	−0.278***	0.050***	3.168***
	(3.74)	(−1.69)	(2.76)	(14.75)
Spouse education: tertiary (binary)	−0.009	−0.952***	−0.029	2.267***
	(−0.55)	(−6.00)	(1.09)	(10.89)
Women work outside of home (binary)	0.004	−0.286***	−0.005	0.366***
	(0.51)	(−3.46)	(−0.06)	(3.76)
Share of nonfarm income in HH income	−0.020		0.108	
	(−0.57)		(1.31)	
Own nonmilk animals (binary)	−0.0004		0.001	
	(−0.04)		(0.06)	
Own fish pond (binary)	0.033***		0.026**	
	(3.05)		(2.41)	
Own milking animal (binary)	0.0001		0.002	
	(0.01)		(0.20)	
Age 6–10 (binary)	0.003		0.004	
	(0.29)		(0.44)	
Age 0–5 (binary)	0.052***		0.059***	
	(5.27)		(5.94)	
Home garden: spices (binary)	−0.017		−0.014	
	(−1.48)		(−1.21)	
Home garden: vegetables (binary)	−0.001		−0.002	
	(−0.08)		(−0.23)	
Home garden: fruits (binary)	−0.014		−0.010	
	(−1.30)		(−0.89)	
Time of interview: 1	−2.983	19.441***	−3.556***	−0.473
	(−1.22)	(8.35)	(−23.87)	(−1.00)
Time of interview: 2	−3.022	19.402***	−3.588***	−0.707*
	(−1.45)	(8.29)	(14.17)	(−1.60)
Time of interview: 3	−3.001	18.394***	−2.558***	−0.776*
	(−1.44)	(7.27)	(−12.33)	(−1.76)

table continues next page

Table 6A.4 Determinants of Dietary Diversity and Body Mass Index (BMI), 2011–12 *(continued)*

Regressors	*Dietary diversity*	*HH BMI*	*Dietary diversity*	*Spouse BMI*
Time of interview: 4	−3.034	19.473***	−3.023***	−0.810*
	(−2.224)	(6.17)	(−14.45)	(−1.83)
Constant	−12.556***	−6.982***	−15.227***	0.081
	(−4.55)	(−8.55)	(−9.44)	(0.98)
R^2	0.36	0.12	0.38	0.14
Observations	5,364	5,364	5,181	5,181

Source: BIHS 2011–12.
Note: Standard errors in parentheses. Estimates are based on three-stage least squares methodology to account for potential endogeneity of dietary diversity index in the BMI equations. Estimates reported are without using district fixed effects. Results for key variables of interest do not change with the inclusion of district fixed effects, with the exception of remittances and the binary indicator for farming households, which both become insignificant. BMI = body mass index; HH = household.
Significance level: *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

Table 6A.5 Determinants of Nutritional Outcomes in Bangladesh with and without Fixed Effects, 2011–12

Regressors	*Wasting (fixed effects)*	*Wasting (no fixed effects)*	*Stunting (fixed effects)*	*Stunting (no fixed effects)*	*Underweight (fixed effects)*	*Underweight (no fixed effects)*
Dietary diversity (logs)	0.132	0.137	0.098	0.038	0.174*	0.153*
	(0.98)	(1.15)	(0.98)	(0.42)	(1.69)	(1.63)
BMI of mother	−0.025**	−0.023**	−0.024***	−0.024***	−0.027***	−0.027***
	(−2.00)	(−1.96)	(−2.68)	(−2.78)	(−2.86)	(−3.03)
BMI of father	−0.061***	−0.057***	−0.029***	−0.030***	−0.042***	−0.045***
	(−4.01)	(−3.96)	(−2.72)	(−2.98)	(−3.69)	(−4.16)
WASH (binary)	0.047	0.063	−0.287***	−0.246***	−0.068	−0.052
	(0.49)	(0.70)	(−4.04)	(−3.56)	(−0.92)	(−0.72)
Community toilets (village share)	−0.174	0.637	0.581	0.089	−0.555	−0.593
	(−0.27)	(1.39)	(1.14)	(0.24)	(−1.01)	(−1.48)
Improved toilets (village share)	−0.265	−0.125	−0.389**	−0.091	−0.409**	−0.192
	(−1.11)	(−0.73)	(−2.26)	(−0.71)	(−2.27)	(−1.43)
Distance to public health facility (log)	−0.014	−0.017**	0.004	0.005	−0.008	−0.010
	(−1.57)	(−2.03)	(0.50)	(0.70)	(−1.06)	(−1.36)
Distance to market (log)	0.0004	0.002	−0.001	−0.001	0.001	0.002
	(0.08)	(0.34)	(−0.21)	(−0.28)	(0.36)	(0.69)
Age of HH head (years, log)	−0.2590	−0.240	−0.044	−0.060	−0.103	−0.090
	(−1.55)	(−1.58)	(−0.36)	(−0.52)	(−0.81)	(−0.75)
HH size (log)	0.965**	0.487	0.319	0.508	0.643*	0.565
	(1.96)	(1.07)	(0.88)	(1.50)	(1.67)	(1.59)
Age of children under 5 (months)	0.001	0.001	0.001	0.001	0.006***	0.006***
	(0.31)	(0.36)	(0.58)	(0.64)	(2.66)	(2.66)
Rice price (log)	−0.050	−0.069	0.017	0.027	−0.008	−0.011
	(−0.75)	(−1.10)	(0.37)	(0.63)	(−0.16)	(−0.25)
Other food price (log)	−0.000	−0.000	−0.000	−0.0001	−0.000	−0.000
	(−0.02)	(−0.60)	(−1.53)	(−1.18)	(−0.62)	(−0.60)
HH assets (log)	0.039	0.036	−0.019	−0.040	−0.032	−0.047*
	(1.02)	(1.05)	(−0.68)	(−1.51)	(−1.07)	(−1.69)
Total expenditure per capita (log)	−0.245**	−0.187*	−0.310***	−0.232***	−0.321***	−0.268***
	(−1.97)	(−1.63)	(−3.48)	(−2.77)	(−3.36)	(−2.99)

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Table 6A.5 Determinants of Nutritional Outcomes in Bangladesh with and without Fixed Effects, 2011–12 *(continued)*

Regressors	*Wasting (fixed effects)*	*Wasting (no fixed effects)*	*Stunting (fixed effects)*	*Stunting (no fixed effects)*	*Underweight (fixed effects)*	*Underweight (no fixed effects)*
Food expenditure per capita (log)	0.489	0.210	0.148	0.197	0.360	0.277
	(1.44)	(1.02)	(0.60)	(0.84)	(1.36)	(1.10)
Health expenditure per capita (log)	0.019	0.004	0.003	0.011	0.014	0.015
	(0.97)	(0.22)	(0.20)	(0.76)	(0.84)	(1.03)
Agricultural diversification	0.167	0.210	0.263	0.156	0.007	−0.065
	(0.73)	(1.02)	(1.48)	(0.96)	(0.04)	(−0.38)
Marital status (married = 1)	−0.328*	−0.297*	0.153	0.112	−0.002	−0.023
	(−1.73)	(−1.69)	(1.02)	(0.77)	(−0.01)	(−0.15)
Religion (Muslim = 1)	−0.311**	−0.199*	−0.030	−0.088	0.020	−0.073
	(−2.36)	(−1.74)	(−0.28)	(−0.95)	(0.19)	(−0.77)
Language (Bengali = 1)	−1.196	−0.987	0.533	0.0478	0.625	0.649
	(−1.41)	(−1.12)	(0.59)	(0.54)	(0.72)	(0.75)
Ethnicity (Bengali = 1)	−0.094	0.119	1.081	1.052	−0.102	−0.007
	(−0.12)	(0.14)	(1.39)	(1.40)	(−0.14)	(−0.01)
Literacy of father (binary)	−0.148	−0.139	0.018	0.007	−0.196***	−0.186**
	(−1.47)	(−1.44)	(0.24)	(0.10)	(−2.48)	(−2.43)
Literacy of mother (binary)	−0.364***	−0.288***	0.058	0.068	0.053	0.057
	(−3.72)	(−3.11)	(0.71)	(0.85)	(0.69)	(0.77)
Father's education: primary (binary)	−0.110	−0.112	0.067	0.067	0.025	0.021
	(−1.07)	(−1.15)	(0.90)	(0.94)	(0.31)	(0.28)
Father's education: secondary (binary)	−0.094	−0.044	−0.036	−0.047	0.004	0.016
	(−1.58)	(−0.79)	(−0.84)	(−1.15)	(0.10)	(0.37)
Father's education: tertiary (binary)	−0.301	−0.169	0.021	0.082	−0.504*	−0.409
	(−0.86)	(−0.52)	(0.09)	(0.36)	(−1.69)	(−1.40)
Mother's education: primary (binary)	−0.011	−0.035	0.059	0.068	0.025	0.010
	(−0.10)	(−0.34)	(0.71)	(0.85)	(0.29)	(0.13)
Mother's education: secondary (binary)	0.285	0.322	−0.613**	−0.619**	−0.423	−0.463
	(0.95)	(1.16)	(−2.22)	(−2.35)	(−1.39)	(−1.54)
Mother's education: tertiary (binary)	−0.117	−0.155	−0.289	−0.393	−0.520	−0.599
	(−0.22)	(−0.31)	(−0.78)	(−1.09)	(−1.03)	(−1.20)
Mother works outside home (binary)	−0.056	−0.119*	−0.054	−0.068	−0.044	−0.603
	(−0.66)	(−1.63)	(−0.85)	(−1.23)	(−0.67)	(−1.04)
Mother works in urban sector (binary)	0.040	0.152	0.044	0.056	0.218	0.170
	(0.07)	(0.26)	(0.10)	(−0.13)	(0.49)	(0.39)
Father works in urban sector (binary)	−0.275	−0.169	0.216**	0.153*	0.130	0.119
	(−1.43)	(−1.28)	(2.16)	(1.63)	(1.21)	(1.22)
Domestic remittance per capita (log)	0.0001	0.001	−0.002	−0.002	−0.004	−0.004
	(0.04)	(0.22)	(−0.57)	(−0.63)	(−1.22)	(−1.19)
International remittance per capita (log)	−0.020***	−0.020***	0.005	0.005	−0.007*	−0.008**
	(−3.30)	(−3.40)	(1.35)	(1.35)	(−1.66)	(−1.97)
Time of interview: 1	−0.337	−0.254	0.613*	0.767***	0.499	0.376
	(−0.79)	(−0.94)	(1.64)	(2.70)	(1.35)	(1.40)
Time of interview: 2	−0.655	0.614**	0.721**	0.898***	0.383	0.315
	(−1.62)	(−2.47)	(2.05)	(3.36)	(1.10)	(1.26)

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Table 6A.5 Determinants of Nutritional Outcomes in Bangladesh with and without Fixed Effects, 2011–12 *(continued)*

Regressors	*Wasting (fixed effects)*	*Wasting (no fixed effects)*	*Stunting (fixed effects)*	*Stunting (no fixed effects)*	*Underweight (fixed effects)*	*Underweight (no fixed effects)*
Time of interview: 3	−0.663*	−0.664***	0.681**	0.870***	0.260	0.255
	(−1.67)	(−2.67)	(1.96)	(3.26)	(0.76)	(1.02)
Time of interview: 4	−0.578	−0.571*	0.733**	0.805***	0.365	0.312
	(−1.55)	(−2.28)	(2.20)	(3.00)	(1.12)	(1.24)
Constant	3.146*	3.942***	1.790	0.497	2.718*	2.385*
	(1.80)	(2.56)	(1.21)	(0.37)	(1.85)	(1.83)
Log likelihood	−783	−822	−1,502	−1,555	−1,383	−1,420
Observations	2,362	2,362	2,362	2,362	2,362	2,362

Source: BIHS 2011–12.
Note: Standard errors in parentheses. BMI = body mass index; HH = household; WASH = water, sanitation, and hygiene.
Significance level: $*p < 0.10$, $**p < 0.05$, $***p < 0.01$.

Bangladesh Dynamic Computable General Equilibrium Model and Additional Results

The Bangladesh Dynamic CGE (BGDDyn CGE) model is built using the Partnership for Economic Policies (PEP) standard recursive dynamic CGE model (Decaluwé et al. 2010). Because a majority of CGE models are static and cannot account for growth effects, they are inadequate for long-run analysis of economic policies or shocks to the economy. By excluding accumulation effects, they do not allow the study of the transition path of an economy, whereas short-run policy impacts are likely to be different from those of the long run. A sequential dynamic CGE model is used to overcome this limitation. The model links a series of static CGE models between periods by updating exogenous and endogenous variables. Capital stock is endogenously updated with a capital accumulation equation, whereas population (and total labor supply) is updated exogenously between periods.

A detailed description of the BGDDyn model, with the static and dynamic modules of the model and model equations, are in Ahmed, Gautam, and Raihan (2015). Briefly, the static model presents the behavior of the economic agents in the economy, whereas the dynamic model shows the transition path of the economy due to any external shock. The BGDDyn CGE model uses the latest available SAM of Bangladesh (for the year 2007). The SAM has four types of accounts: (a) production activity and commodity accounts for 32 sectors; (b) four factors of production with two types of labor and two types of capital; (c) current account transactions between four main institutional agents: household members and unincorporated capital, corporation, government, and the rest of the world; and (d) a consolidated capital account to capture the flows of savings and investment. The activities, commodities, factors, and institutions in the SAM are in table 6A.6. For simulation results, see tables 6A.7 and 6A.8.

Table 6A.6 Description of the Bangladesh 2007 Social Accounting Matrix (SAM)

Set	*Description of elements*
Commodities (32)	
Agriculture (12)	Paddy cultivation, wheat cultivation, other grain cultivation, potato cultivation, vegetable cultivation, pulses cultivation, fruit cultivation, other crop cultivation, livestock rearing, poultry rearing, fishing, forestry
Industry (10)	Rice milling, grain milling, food process, manufactured goods-rural, manufactured goods-urban, petroleum, construction-rural, construction-urban, electricity and water generation, mining and gas
Services (10)	Trade-rural, trade-urban, transport-rural, transport-urban, housing service, health service, education service, public administration and defense, services-rural, services-urban
Factors of production (4)	
Labor (2)	Labor unskilled, and labor skilled
Capital (2)	Capital and land
Current institutions (11)	
Households (7)	Rural: landless, marginal farm, small farm, large farm, nonfarm day labor, nonfarm others Urban: households with low educated heads, and households with high educated heads
Others (3)	Government, corporation, and rest of the world
Capital institution (1)	
Consolidated capital account	

Table 6A.7 Simulated Change in Local Prices of Food in Agricultural Scenarios, 2015–30
annual change, percent

Food category	*Business as usual*	*Agricultural acceleration*	*Rice-only acceleration*	*Nonrice crops and forestry acceleration*	*Livestock and poultry acceleration*	*Fisheries acceleration*
Potato	–0.22	–0.63	–0.13	–0.78	–0.20	–0.18
Vegetables	–0.19	–0.54	–0.10	–0.68	–0.17	–0.15
Pulses	–0.27	–0.66	–0.18	–0.79	–0.26	–0.23
Fruit	–0.30	–0.78	–0.21	–0.93	–0.28	–0.26
Other crop	0.32	0.00	0.41	–0.15	0.35	0.35
Livestock	–0.21	–0.44	–0.19	–0.18	–0.53	–0.17
Poultry	–0.24	–0.71	–0.17	–0.35	–0.70	–0.21
Fishing	–0.35	–0.68	–0.26	–0.29	–0.33	–0.85
Milled rice	–0.16	–0.50	–0.63	–0.10	–0.14	–0.13
Milled grain	0.28	0.30	0.38	0.14	0.30	0.31
Processed food	0.07	0.22	0.16	0.08	0.08	0.08
Average	*–0.10*	*–0.40*	*–0.09*	*–0.37*	*–0.12*	*–0.10*

Source: Simulation results.
Note: The average is the unweighted average of the growth rates in the price.

Table 6A.8 Simulated Change in Local Prices of Food in Nonagricultural Scenario, 2015–30
annual change, percent

Food category	*Business as usual*	*Nonagricultural acceleration*	*Rice and nonagricultural acceleration*	*Balanced acceleration*
Potato	–0.22	0.09	0.17	–0.34
Vegetables	–0.19	0.58	0.10	–0.28
Pulses	–0.27	0.55	0.03	–0.40
Fruit	–0.30	0.09	–0.08	–0.36
Other crop	0.32	0.08	0.82	0.43
Livestock	–0.21	0.01	–0.06	–0.27
Poultry	–0.24	0.11	0.20	–0.29
Fishing	–0.35	0.75	–0.21	–0.44
Milled rice	–0.16	0.17	0.54	–0.25
Milled grain	0.28	–0.10	0.05	0.36
Processed food	0.07	–0.24	0.10	0.09
Average	*–0.10*	*0.10*	*1.10*	*–0.13*

Source: Simulation results.
Note: The average is the unweighted average of the growth rates in the price.

Notes

1. Average imports of rice in recent years have been equivalent to less than 2 percent of domestic production.
2. Different researchers put the desirable calorie intake at different levels. Talukder et al. (2015) report desirable calorie intake to be 2,430 kilocalories per capita per day, which places current calorie levels slightly below desired levels.
3. As Yu et al. (2010) concluded when assessing the impact of climate change on agriculture.
4. The results reported here are without using district fixed effects, since their inclusion clouds the influence of some variables, but the main variables of interest give very similar results. To allow for potential endogeneity in dietary diversity with BMI, the two relationships are estimated simultaneously using the three-stage least squares procedure.
5. Labor supply is assumed to grow at the same rate as the working-age population, and the skill composition of the labor supply remains constant. The growth of the working-age population is based on projections from the *United Nations World Population Projections: The 2012 Revision* (United Nations 2013). The constant skill composition assumption for the labor supply is a conservative assumption, given that the benefits of improved educational attainment over the next six years will not be seen clearly in the labor supply composition in the time horizon under consideration.

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CHAPTER 7

Priority Areas for Action

Introduction

This study has approached the challenge of promoting growth—particularly rural growth—through an examination of the nature, dimensions, and drivers of rural poverty. The analysis has documented recent changes in the rural economy, identified key drivers of emerging trends, and assessed the implications of those changes for future growth, poverty reduction, food security, and nutrition. This concluding chapter briefly lists the areas of highest priority for policy and strategy to strengthen and sustain an environment that enables more rapid growth and poverty reduction.

- ***A balanced development strategy.*** A development strategy that stresses both farm and nonfarm growth and at the same time pursues a diversified strategy within agriculture (favoring no agricultural subsector over others), is superior to alternative sector-specific strategies in all dimensions of development: pursuing growth, furthering the gains in poverty reduction, reducing economic vulnerability, maintaining food security, and promoting better outcomes in nutrition.

- ***More rapid diversification in agriculture—with carefully balanced attention to rice.*** Within agriculture, diversification into high-value agriculture (noncrop agriculture and crops other than rice) is a priority, but it is important to neither neglect nor overemphasize the rice sector. Consolidating the prospects for rice is important and is eminently feasible through an approach that emphasizes exploiting the remaining yield gaps, investing in traditional and nontraditional technologies (planting hybrids and responsibly realizing the potential of biotechnology), and leveraging the private sector to move the current technology frontiers. This approach will safeguard past achievements while injecting new momentum into productivity growth, and it will be critical in building resilience to potential climate change impacts. Strategic priorities include improving *aman* rice yields and freeing up the more suitable *boro* areas for a diverse

range of high-value and more sustainable crops, and giving greater attention to various aspects of developing the high-value crop, livestock, poultry, and fisheries subsectors.

- ***Further improving the policy framework and rebalancing public expenditure priorities.*** At the macro level, policy distortions protecting the nonfarm economy remain and create an implicit anti-agriculture domestic bias. The main issues are analyzed in the Diagnostic Trade Integration Study by the World Bank, which also identifies key actions to address them. Among sectoral policies, a careful review is warranted to assist farmers in pursuing economically and ecologically optimal use of inputs. Evidence indicates that significant wastages (with large environmental and health costs) are associated with the overuse of chemical fertilizers, which may be due to insufficient technical knowledge or inappropriate incentives. Rationalizing public expenditures to emphasize investments in research (with increased attention to nonrice crops, livestock, and fisheries), extension services, markets, and infrastructure will help to enhance incomes, value chain efficiencies, and competitiveness. Finally, removing the remaining regulatory and institutional constraints to private sector participation in the seed sector will have a large potential payoff.

- ***An enabling environment for robust rural nonfarm growth and more efficient value chains.*** For rural nonfarm growth, especially the growth of business enterprises, the empirical analysis reaffirms the essential role of the enabling environment. Access to finance, power, and roads are critical elements, as are better access to technology and information, and the removal of business environment barriers (such as those influencing terms of trade, discriminatory taxes, and stifling regulations). Value chain analyses highlight the importance of focusing on food safety standards and modern market infrastructure, given the large share of rural nonfarm enterprises that pursue activities related to agriculture (such as trading and processing). The value chain analyses also clearly show that agricultural markets are functioning quite efficiently, with low marketing margins (driven mostly by transport costs), dispelling the general myths on the distortions and inefficiencies associated with the liberalized market environment. The clear priority is to avoid distracting debates and focus on improving market infrastructure and facilitating more efficient value chains.

- ***Continued investment in connectivity.*** The widespread impact of connectivity is well demonstrated. Looking to the future, continued investments in infrastructure are a high priority. Rural roads have been a key part of the past success in raising productivity, promoting the limited diversification that has taken place, and creating better employment opportunities. Closely related to connectivity is the need to focus on secondary cities that remain

poorly connected, because they are potential drivers of economic activity and better quality jobs. The evidence shows that while the megacities have attracted more employment, they have overwhelmingly attracted informal jobs with higher vulnerability. Well-connected cities have had positive growth in business jobs, while poorly connected cities have languished, with no structural change in the types of jobs created.

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The rural economy in Bangladesh has powerfully advanced economic growth and substantially reduced poverty, especially since 2000, but the remarkable transformation and unprecedented dynamism in rural Bangladesh remain an underexplored, underappreciated, and largely untold story. *Dynamics of Rural Growth in Bangladesh: Sustaining Poverty Reduction* tells that story and inquires what specific actions Bangladesh might take—given the residual poverty and persistent malnutrition—to accelerate and channel its rural dynamism to sustain the gains in eliminating poverty, achieving shared prosperity, and advancing national aspirations to achieve middle-income status.

The central element of this study, undertaken with the Government of Bangladesh Planning Commission to address key questions elicited through extensive consultation, is an empirical analysis that illuminates the underlying dynamics of rural growth, particularly the role of agriculture and its relationship to the nonfarm economy. Using all sources of data available for the macro-, meso-, and microhousehold levels, the analysis provides new evidence on changes in the rural economy and the principal drivers of rural incomes. It also examines market performance for high-value agricultural products and agriculture–nutrition linkages, based on new surveys and analysis. The resulting evidence, examined in light of the rich knowledge of rural development in Bangladesh, is used to delineate the implications for policy and the strategic priorities for sustaining future rural development, poverty reduction, food security, and nutrition.

The effects of policy reforms, changes in technology, and investments in infrastructure and human capital described here, along with the persistent enterprise of rural Bangladeshi households, offer a compelling case study of how mutually reinforcing actions can trigger the highly-sought-after virtuous cycle of rural development. The findings clearly demonstrate the pro-poor nature of agricultural growth and its catalytic role in stimulating the rural nonfarm economy. They show that households have no linear or predictable pathway out of poverty; instead, they wisely employ a combination of farm and nonfarm income strategies to climb out of, and then stay out of, poverty. The results represent a strong contribution to the global thinking on rural transformation and on how agriculture in particular sustains the economic momentum that fosters poverty reduction and more widespread prosperity.

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ISBN 978-1-4648-0876-0
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9 781464 808760
SKU 210876