Impact of Agricultural Trade Liberalisation on the Welfare of Rural Communities in Bangladesh

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Dedication

I dedicate this research to my parents – Satyabrata Talukder and Satyabama Talukder who have always encouraged me to acquire knowledge. I also dedicate this study to small farmers and agricultural labourers who toil to feed the large and growing population of Bangladesh.

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Abbreviations

BBS	Bangladesh Bureau of Statistics
DEA	Data Envelopment Analysis
EU	European Union
GDP	Gross Domestic Product
GNI	Gross National Income
HHES	Household Expenditure Survey
HHIES	Household Income and Expenditure Survey
HHS	Household Survey
HYV	High Yielding Varieties
IMF	International Monetary Fund
LDCs	Least Developed Countries
NGOs	Non-governmental Organisations
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
SAR	Structural Adjustment Reforms
TFP	Total Factor Productivity
TC	Technological Change
TEC	Technical Efficiency Change
UNDP	United Nations Development Programme
UNICEF	United Nations Children’s Fund
US	United States
USA	United States of America
WTO	World Trade Organisation

Attestation of Authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

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Abstract

The objective of this study was to analyse the impact of agricultural trade liberalisation on the welfare of rural households in Bangladesh. The study used both primary and secondary data and employed multiple models and estimation techniques including the Data Envelopment Analysis (DEA)-based Malmquist productivity index, Ordinary Least Square (OLS) regression methods, Two-stage Least Square regression technique, and index number approaches. It estimated changes in productivity and prices of rice, income distribution, inequality, and poverty as a result of agricultural trade liberalisation.

The study found that agricultural trade liberalisation positively influenced total factor productivity (TFP)-growth of rice, benefiting farm households directly. However, increased productivity led to a decrease in both producer and consumer prices of rice. The magnitude of the decrease in producer price was higher than that in consumer price, implying that farm households experienced loss from this price decrease. Non-farm households experienced greater growth in consumption and real income than farm households. Amongst farm households, large and medium farmers experienced higher growth in real income than small farmers.

Rural households experienced an increase in inequality – the rich captured a progressively larger share of income but the poor subsequently received a lower share. Although all rural households experienced a moderate to high growth rate in real income and consumption, rich households gained more than poor households, suggesting that the growth was not pro-poor, thereby resulting in insignificant poverty reduction during 1985-86 to 2005. Non-farm households experienced greater reduction in poverty than farm households. Amongst all groups of rural households, small farmers experienced the lowest reduction in poverty over the same period. The main reason for the low rate of poverty reduction was attributed to an increase in inequality along with economic growth. If the inequality was held constant at the 1985-86 level, the poverty could have been reduced to zero in 2005 with the level of growth experienced by Bangladesh in the post-liberalisation era.

Agricultural trade liberalisation adversely affected the environment in the form of loss of soil fertility, destruction of bio-diversity, and environmental pollution. The study

argues that agricultural trade reform policies were not adequate to confer benefits derived from agricultural trade liberalisation to the poor. The government should formulate and implement complementary policies to reduce inequality and translate the growth into poverty reduction as well as to protect the environment.

CHAPTER ONE

Introduction and Background of the Study

1.1 Introduction

Bangladesh is an agricultural country. More than 80 percent of its population depend directly or indirectly on agriculture for their livelihoods. This segment of the population is also predominantly made up of rural households. The agricultural sector contributes around 20 percent to gross domestic product (GDP) and employs more than 60 percent of the total labour force of the economy.

Bangladesh went through a series of deregulation and agricultural trade liberalisation measures in the late 1980s and early 1990s. It experienced significant productivity growth in agriculture over the last two decades (1990-2010) as a result of agricultural trade liberalisation. This study attempted to analyse the impact of agricultural trade liberalisation on the welfare of rural households in Bangladesh.

The aim of this chapter is to present an analytical framework including background, theoretical and empirical contexts, and the structure of the study. This chapter begins with a brief description of agricultural trade liberalisation scenarios in Bangladesh. It also presents the rationale for undertaking this study; outlines objectives, and scope and limitation of the study; and poses the main research question – how has agricultural trade liberalisation impacted on the welfare of rural households in Bangladesh? It briefly discusses the structure of the thesis with a view to explaining how the study is designed to achieve its objectives. It also explains how this research could contribute to the knowledge and practices related to agricultural trade liberalisation.

1.2 Agricultural Trade Liberalisation Scenarios in Bangladesh

Like many other developing countries in the world, Bangladesh had pursued inward-looking policies and strategies for trade and development since its independence in 1971. These policies involved high government interventions in almost all economic activities including agriculture (Ahmed *et al.*, 2007: 2, 7; Draper and Sally, 2005: 3; Hoque and Yusop, 2010: 1; Rahman, 2008: 5). Bangladesh encouraged cooperative farming with a view to developing a socialist system of agriculture during the 1970s. The government controlled the procurement and distribution of seeds, fertilisers, pesticides and all other agricultural inputs and equipment (Ahmed, *et al.*, 2007: 2, 7; Ahmed and Sattar, 2004: 11; Salim and Hossain, 2006: 2568).

The government adopted import substitution policies with restrictions on imports to protect and support domestic production. It controlled the foreign trade and exchange rate system for making interventions effective (Ahmed and Sattar, 2004: 11; Krueger, 2010: 2; Nahar and Siriwardana, 2009: 327; Salim and Hossain, 2006: 2568). A series of measures including quantitative restrictions, highly differentiated tariff rates (ranging from 0 to 400 percent), huge production subsidies, and overvalued exchange rates were put in place to protect domestic production from world competition (Ahmed, *et al.*, 2007: 7; Ahmed and Sattar, 2004: 11; Nahar and Siriwardana, 2009: 327; Salim and Hossain, 2006: 2568).

The government reinforced this protective environment with domestic market policy interventions in the form of credit ceilings, price controls, and arbitrary licensing such as import licence. These licences were granted only when there was no domestic source of supply available (Ahmed, *et al.*, 2007: 19; Islam and Habib, 2007: 10, 14; Krueger, 2010: 2; Salim and Hossain, 2006: 2568). Moreover, traditionally, a government department – the Bangladesh Agricultural Development Corporation (BADC) had the sole authority and responsibility for procurement and distribution of agricultural inputs including fertilisers, irrigation equipment, pesticides and seeds (Ahmed, *et al.*, 2007: 19, 21; Islam and Habib, 2007: 10, 14; Rahman, 2008: 13; Salim and Hossain, 2006: 2568).

However, these inward-oriented trade policies were not successful in terms of trade expansion as well as import substitution. These policies did not result in a sustained increase in production and productive efficiency. Rather, the gap between demand for and supply of agricultural goods widened over the years (Ahmed, *et al.*, 2007: 7; Hoque and Yusop, 2010: 39; Salim and Hossain, 2006: 2568). With a growing dissatisfaction regarding inward-looking trade and development policies, the sustainability of the government interventions towards long-term food-grain availability was questioned due to the increased inefficiency and corruption in the public management system and the heavy budgetary burden imposed by these operations (Ahmed, *et al.*, 2007: 6, 7; Dorosh and Shahabuddin, 2002: 38; Hoque and Yusop, 2010: 39; Krueger, 2010: 5; Salim and Hossain, 2006: 2569).

Realising such inefficiencies as well as constant pressures from the donor countries and international development agencies such as the World Bank and the IMF, the government started to pursue a policy-shift from state intervention to more market-oriented policies in the mid 1980s with a view to achieving high economic growth and reducing poverty (Ahmed, *et al.*, 2007: 9; Hoque and Yusop, 2010: 39; Hossain and Verbeke, 2010: 78; Islam and Habib, 2007: 3; Nahar and Siriwardana, 2009: 327; Rahman, 2008: 11; Salim and Hossain, 2006: 2567, 2569). Deregulation and agricultural trade liberalisation generated a momentum that began in the late 1980s and peaked in the early 1990s. Major reforms in agricultural policy included liberalisation of input markets, shrinking the role of government agencies in distribution of inputs, substantial reduction and rationalisation of tariffs, removal of quantitative restrictions, moving from multiple to a unified exchange rate, and from fixed to a flexible exchange rate system (Ahmed, *et al.*, 2007: 9; Ahmed and Sattar, 2004: 11, 12; Hoque and Yusop, 2010: 39; Hossain and Verbeke, 2010: 78; Islam and Habib, 2007: 4; Salim and Hossain, 2006: 2569).

Similarly, the government pursued a wide range of policy reforms to liberalise agricultural input markets including privatisation of the distribution system of key agricultural inputs, initiatives for deregulation measures to improve the investment climate for private enterprises, gradual elimination of subsidies on fertilisers and small irrigation equipment, and improving the maintenance of agricultural equipment through encouraging participation of the private sector (Ahmed, 2004: 11, 12; Ahmed, *et al.*, 2007: 9; Klytchnikova and Diop, 2006: 3; Salim and Hossain, 2006: 2569).

As a consequence of these reforms, the fertiliser trade was almost entirely handled by the private sector in 2005 (Ahmed, *et al.*, 2007: 19, 20; Ahmed and Sattar, 2004: 13, 19; Klytchnikova and Diop, 2006: 3; Salim and Hossain, 2006: 2569). Further policy reforms included rationalisation or elimination of import duties on agricultural inputs and spare parts; elimination of the government monopoly in fertiliser imports; and abolition of standardisation requirements (Ahmed, *et al.*, 2007: 19, 20; Ahmed and Sattar, 2004: 13, 19; Klytchnikova and Diop, 2006: 3; Salim and Hossain, 2006: 2569).

There were encouraging responses to these liberalisation and reform initiatives from market forces. Therefore, the private sector participation in the input market rose sharply. Irrigation equipment became cheaper and farmers had easy access to the equipment. Different types of high yielding variety (HYV) seeds were available to farmers, thereby promoting both extensive and intensive cultivation by increasing the irrigated area and use of fertilisers (Klytchnikova and Diop, 2006: 3; Salim and Hossain, 2006: 2569).

Consequently, agricultural trade liberalisation generated significant impacts on economic growth through productivity improvement in the agricultural sector. It contributed to technological innovation in agriculture, leading to productivity improvement of agricultural inputs (Ahmed and Sattar, 2004: 19; Islam and Habib, 2007: 4; Klytchnikova and Diop, 2006: 3). The reform measures – including liberalisation of the input markets for fertilisers, pesticides, and irrigation equipment and adoption of high yielding variety seeds for rice production – led to major structural reforms and technological transformation, resulting in a significant increase in productivity and growth in the agricultural sector. Technological changes in agricultural production enabled the country to achieve self-sufficiency in food-grain production in the early 1990s (Ahmed and Sattar, 2004: 19; Islam and Habib, 2007: 4; Klytchnikova and Diop, 2006: 3). The rising volume of rice production was accompanied by a decline in rice prices during 1990-2009. Moreover, because of significant structural transformation and technological changes, productivity of this sector was at its highest level (BBS, 2009a: 3; Klytchnikova and Diop, 2006: 2; Ministry of Finance, 2010: 84).

These structural transformations reflected the government’s efforts to open the economy, liberalise agricultural trade and reform domestic markets in the 1980s and 1990s (Ahmed and Sattar, 2004: 12; Klytchnikova and Diop, 2006: 2). They enabled the economy to achieve a significant growth in the 1990s – increase in real GDP by an average of 4.2 percent per year and significant increases in agricultural production (Klytchnikova and Diop, 2006: 2; Salim and Hossain, 2006: 2570).

Despite this impressive growth performance, the rate of decline in the incidence of poverty over the two decades 1990-2010 was rather insignificant. The decline in poverty was an average of less than 1 percent (over the twenty-year period), leaving poverty at a remarkably high level – with more than 40 percent of the country’s population and the majority of them in rural areas (Ahmed and Sattar, 2004: 18; BBS, 2007b: 57; Klytchnikova and Diop, 2006: 2; Ministry of Finance, 2010: 177). Thus, a significant question arises – to what extent has agricultural trade liberalisation influenced the welfare of rural communities in Bangladesh?

1.3 Rationale and Significance of the Study

In spite of significant structural transformation and policy changes, to date, there have been no systematic and dynamic attempts to evaluate and analyse the impact of agricultural trade liberalisation on productivity, price change, income distribution, and poverty. Studies that have attempted to shed light on these issues have focused rather narrowly on the overall economic impact of agricultural trade liberalisation. None of these studies has focused specifically on 'how agricultural trade liberalisation has impacted on the welfare of rural households', which is the focus of this PhD study. Therefore, there is a strong case for rigorous and critical investigation into its consequences and implications, either in broad spectrum or with specific reference to a particular group of individuals of the economy. Some of these major studies on this effect include: Globalisation-Poverty Links in Bangladesh: Some Broad Observations (Mujeri, 2002); Poverty Implications of Trade Liberalisation in Bangladesh: A General Equilibrium Approach (Mujeri and Khondker, 2002); Poverty in Bangladesh: Building on Progress (World Bank, 2002); Rice Price Stabilization on Bangladesh: An Analysis of Policy Options (Dorosh and Shahabuddin, 2002); Trade Liberalisation and the Crop Sector in Bangladesh (Hossain and Deb, 2003); Trade Liberalisation, Growth and Poverty Reduction: The Case of Bangladesh (Ahmed and Sattar, 2004); Poverty Alleviation Through Agriculture and Rural Development in Bangladesh (Hossain, 2004); Promoting Rural Non-Farm Sector in Bangladesh (World Bank, 2004b); Bangladesh: Country Environmental Analysis (World Bank, 2006); Market Deregulation, Trade Liberalisation and Productive Efficiency in Bangladesh Agriculture: An Empirical Analysis (Salim and Hossain, 2006); Trade Reforms, Farm Productivity, and Poverty in Bangladesh (Klytchnikova and Diop, 2006); Political Economy of Trade Liberalisation in Bangladesh: Impact of Trade Liberalisation on Bangladesh Agriculture (Rahman, 2008); Agriculture Census 2008 (BBS, 2009a); Impact of Shallow Tube-wells and Boro Rice on Food Security in Bangladesh (Hossain, 2009); Impact of Trade Liberalization on Poverty in Bangladesh (Nahar and Siriwardana, 2009); Evaluation of Rice Markets Integration in Bangladesh (Hossain and Verbeke, 2010); Welfare Impact of Policy Interventions in the Foodgrain Markets in Bangladesh (Alam *et al.*, 2011); and Impact of Increasing Prices of Agricultural Commodities on Poverty (Karfakis *et al.*, 2011). They are mainly in the form of reports of development projects of government departments, non-governmental organisations (NGOs) and international donor agencies.

Most of these studies were undertaken as development projects of donor agencies with a target of achieving specific results to introduce new technologies, some of which were not suitable for the local economy and environment. For instance, the introduction of tube-well technology by UNICEF and the UNDP for safe drinking water in rural areas in the 1980s resulted in arsenic pollution leading to serious health hazards and environmental catastrophes in Bangladesh (Adeel, 2001: 271; Bhattacharya *et al.*, 1999: 11; Islam and Habib, 2007: 2). Similarly, with the recommendations of the OECD's Development Assistance Committee and under the Structural Adjustment Reforms (SAR) programme of the World Bank, the donor agencies led by the World Bank spent billions of dollars on poverty projects in Bangladesh but the impact of these efforts on poverty reduction was considered as insignificant. It is argued that the absence of an adequate national framework and the abundance of donors' strategies without local experience created a big gap of knowledge, which caused these programmes to be unsuccessful (Alauddin and Quiggin, 2008: 112; Bhattacharya and Titumir, 2000: 1-4; Islam and Habib, 2007: 2, 3). In the same way, an embankment technology was applied to shrimp cultivation projects for developing commercial shrimp farms in the coastal areas of Bangladesh. While the commercial shrimp sector was developed there was little sensitivity to local knowledge, practices, preferences and resource use, leading to negative consequences in terms of loss of bio-diversity, increased salinity, destruction of mangroves and other negative socio-economic effects (Alauddin and Quiggin, 2008: 112; Bhattacharya, *et al.*, 1999: 2, 8; Islam and Habib, 2007: 2, 3).

Considering the above experiences, it is important to analyse the impacts of agricultural trade liberalisation cautiously with special attention to local sensitivity and experience, which is the focus of this study. Furthermore, given the significant impact of agricultural trade liberalisation policy-exercise on more than 80 percent of the country's population (dependent on agriculture and predominantly rural households), there is a strong justification for a rigorous study into its consequences and implications.

Thus, the study has attempted to address the following issues resulting from agricultural trade liberalisation: productivity growth in agriculture; price changes; income distribution, inequality and poverty; and other socio-economic issues such as use of natural resources, environment, externalities, market failure, infrastructure improvement, non-farm sector development, and changes in social relationship with a view to developing policy frameworks and undertaking relevant measures for increasing the welfare of rural households.

In addition, the study:

1. has divided rural households into different groups (such as farm and non-farm households; agricultural labourers, small farmers, medium farmers and large farmers; and net sellers and net buyers) with a view to mapping out who gained and who experienced loss from agricultural trade liberalisation.
2. has attempted to establish a basis for a conceptual framework to analyse the agricultural growth multiplier effects that have been captured by such income groups as non-farm households. These multiplier effects are considered as spill-over effects of agricultural growth on the non-farm sector of the rural economy in Bangladesh.
3. has shed light on such issues as income distribution, inequality and poverty and suggested policies and relevant measures to address these issues.
4. has also attempted to focus on some important issues such as operation of local rice markets, development of rural infrastructure, and storage facilities and identified policies and measures related to these issues.
5. has analysed some important issues like environment, externalities, market failure etc. and indicated related policy dimensions to address these issues.
6. by undertaking an in-depth analysis of the experience of Bangladesh, the study hopes to contribute to wider debates around the issues of agricultural trade liberalisation itself. This includes issues relating to the analysis of its impacts (methodological and analytical aspects), the formulation of appropriate policies and measures, and the implementation of trade liberalisation programmes.

1.4 Objectives of the Study

The main objective of this study is to analyse the impact of agricultural trade liberalisation on the welfare of rural households in Bangladesh. The focus of this study is to explore the changes in welfare of rural households due to the changes in productivity and prices of rice as a result of agricultural trade liberalisation.

The study focuses on a link between agricultural trade liberalisation measures and their impacts on technological transformation in agriculture, productivity growth, changes in producer and consumer price as well as on changes in household welfare. A change in agricultural productivity affects directly the welfare of farm households and may affect indirectly the welfare of both farm and non-farm households through changes in producer and consumer price of agricultural products. These changes may have impact on household income and consumption as well as on rural poverty. Although other factors may also have affected the growth in real income of rural households, agricultural trade liberalisation is the most important policy reform because of households' crucial dependence on agriculture in terms of both income and consumption.

1.5 Research Questions

The key research question is – how has agricultural trade liberalisation impacted on the welfare of rural households in Bangladesh? Due to the size of the agricultural sector in Bangladesh, and the complexity of the trade liberalisation policies, this study has selected rice as a case study. Rice is the dominant crop in many rural areas because it is both a food and a cash crop. Agricultural trade liberalisation also impacted on many of the inputs into rice production such as irrigation, fertilisers, technologies, and rice varieties. Therefore, a series of subsidiary questions were developed to help address the main research question. Thus, subsidiary research questions include:

a) In what ways has agricultural trade liberalisation affected productivity of rice in Bangladesh?
b) In what ways has agricultural trade liberalisation impacted on prices of rice in Bangladesh?
c) In what ways has agricultural trade liberalisation impacted on income and consumption of rural households in Bangladesh?

d) In what ways has agricultural trade liberalisation impacted on poverty reduction, inequality and income distribution of rural households in Bangladesh?
e) What policies confer positive and significant impacts of agricultural trade liberalisation to the welfare of rural households in Bangladesh?

1.6 Scope and Limitations of the Study

1.6.1 Scope

This study concentrated only on rural households and excluded urban households from the research for two obvious reasons. Firstly, more than 80 percent of the country's population live in rural areas and are much more affected by agricultural trade liberalisation than those in urban areas. Secondly, more than 80 percent of the population of the country are dependent directly or indirectly on agriculture and they are predominantly the rural households.

Similarly, the study considered only the rice crop for analysing the impact of agricultural trade liberalisation on the welfare of rural households for two main reasons. Firstly, agricultural trade liberalisation influenced rice production significantly: agricultural trade liberalisation directly impacted on new technology for rice production (such as irrigation, fertilisers, and high-yielding-varieties seeds). Secondly, rice is the major agricultural product in Bangladesh, capturing the largest share of the agricultural sector. It accounted for 75 percent of the total crop production value, 63 percent of total crop sales, and 75 percent of total cultivated area of the country in 2005 (Klytchnikova and Diop, 2006: 13). In addition, rice is the staple food in the economy. Therefore, any change in rice production and the price of rice impacts directly on the livelihoods and welfare of most households in the country.

1.6.2 Limitations

The main limitations of the study are as follows:

1. This study focused only on rice crops because taking the entire agricultural sector would be too big for a PhD study with limited resources undertaken by one student.

2. Similarly, the study was limited to analyses of the impact of agricultural trade liberalisation on the welfare of rural households, thereby excluding urban households.
3. Although agricultural trade liberalisation is the most important policy reform, other factors also (for instance political regime change) may affect the welfare of rural households. This study did not consider the impact of other factors due to limitation of time and space of this PhD study.
4. The study did not aim at quantifying future demand and supply patterns of rice in Bangladesh. It focused on the analysis of household welfare using data over a 20-year period between 1990 and 2010.
5. The study would greatly benefit from an extensive field survey on a large sample size, but time and resource (fund) constraints limited the fieldwork to a sample of only 60 households of one village of the Comilla District in Bangladesh. (The ethics approval by the AUTEC does not allow to identify the village in this thesis.)
6. Community capitals framework – developed by Flora and Flora (2004); Flora, Bregendahl, Fay, Chen and Friel (2004); and Emery and Flora (2006) – examines the assets that exist within and are invested in the community, namely natural, cultural, human, social, political, financial and built capitals. It extends the concept of social capital developed by Putnam (1994, 2000) and Granovetter (1973, 1985). The community capitals framework is extensively used in ecosystems studies (Donoghue and Sturtevant, 2007), community development and analysis of rural economies (Chaskin, 2001; Laverack, 2001). While this PhD study examined the impact of agricultural trade liberalisation on the welfare of rural households in Bangladesh, it did not undertake an analysis of the resource base of rural communities and so did not adopt the community capitals framework for analysis. Using this framework will no doubt provide a much broader understanding of the resources available for community development, but this is beyond the scope of this present study.

1.7 Structure of the Thesis

The thesis is divided into ten chapters. *Chapter One* provides a general introduction to the study and presents the rationale and significance of this study, the objectives, research questions, and scope and limitation of the study.

Chapter Two analyses the socio-economic structure of Bangladesh with a view to drawing a socio-economic picture of the study-country as a basis for understanding the socio-economic conditions and characteristics of the rural households. It provides an overview of the Bangladesh economy including its structure, the state of public ownership, the development of private sector, government and administrative structure, and the agricultural trade structure. It has overviewed the population structure of the economy. It concludes by highlighting some of the fundamental issues of the economy such as land reforms, poverty, inequality, and income distribution.

Chapter Three presents a review of the literature, focusing on the main debate between the advocates and the critics of trade liberalisation, as well as empirical evidence on impacts of trade liberalisation. Some of the key themes examined in the literature include debate on gains and losses from agricultural trade liberalisation; growth and distributional consequences resulting from agricultural trade liberalisation; the theoretical aspects of welfare dynamics and changes in welfare due to technological improvement as a result of agricultural trade liberalisation. The review focuses mainly on how agricultural trade liberalisation can affect economic growth, welfare of rural households and distribution of income through technological transformation in agriculture. It concludes by presenting Bangladesh's agricultural trade liberalisation process and issues, and critically examining some of the major studies related to agricultural trade liberalisation in Bangladesh.

Chapter Four describes the methodology used in this study, and the methods and techniques for data collection and analysis. The theoretical and empirical approaches of the methodology provide insight into the mathematical, econometrical, and statistical tools and techniques used in analysing and presenting the findings of the study.

Chapter Five discusses the characteristics of rural households and rice cultivation in Bangladesh with a view to understanding the context and issues of agricultural trade liberalisation and their impacts on the welfare of rural households. The characteristics of rural households include household types by activities, land ownership, dwelling conditions, demographic characteristics, and educational backgrounds. It also outlines household income and consumption patterns. Since the study has considered the changes in productivity and prices of rice only for analysing the impact of agricultural trade liberalisation on the welfare of rural households, this chapter highlights the characteristics of rice cultivation such as types of rice, characteristics of land use, stages involved in rice production, and the cost of rice production. It also analyses households' involvement with the rice market such as rice production, selling and buying.

Chapter Six presents the empirical results of the study related to changes in productivity of rice and the welfare of rural households. It maps out how agricultural trade liberalisation has affected productivity of rice through technological transformation and also analyses the changes in the use of factors of rice production such as fertilisers, irrigation, pesticides, and seeds. In addition, it examines how agricultural trade liberalisation influenced the cropping patterns, cropping intensity, rice production, total factor productivity (TFP)-growth and factors of production. The determinants of output are analysed by using input- and output-oriented regression models.

Building on the analyses of the impact of trade liberalisation on rice production, *Chapter Seven* proceeds to *analyse* the empirical findings of the impact of agricultural trade liberalisation on the welfare of rural households through changes in their income and consumption as a result of changes in both producer and consumer prices of rice. Using growth incidence curves, it maps out and compares growth in real income experienced by different groups of rural households. It decomposes income growth by sources and identifies determinants of income as well as determinants of growth in real income. Like income, changes in household consumption, elasticity of demand for consumption, growth in real consumption, and determinants of consumption are critically analysed to provide insights into changes in household welfare due to agricultural trade liberalisation.

Households in rural areas consist of rich and poor, farming and non-farming as well as landowners and labourers. Welfare impacts are therefore not equally distributed amongst different household groups. *Chapter Eight* analyses the findings related to income distribution, inequality, and poverty reduction amongst the rural communities and maps out the impact on welfare amongst the different rural household groups.

Chapter Nine examines the environmental and other socio-economic impacts; impacts on land and water through the application of agricultural inputs such as chemical fertilisers and pesticides to rice cultivation; changes in social relationships; changes in infrastructure; and the development of the rural non-farm sector in the economy.

Chapter Ten discusses policy implications including measures and capacity-sensitive trade policies needed to enhance the welfare of rural households. It also indicates dimensions and scopes of future research related to this study.

CHAPTER TWO

Agricultural Trade Liberalisation and Bangladesh Economy: An Overview

2.1 Introduction

Having presented the objectives, research questions and structure of the thesis in the preceding chapter, this chapter analyses the basic socio-economic characteristics of the study country. It investigates the recent development trends as well as the basic characteristics of the economy. The chapter is divided into the following sections: an overview of the socio-economic characteristics of the economy; government and administrative structure; trade structure; characteristics of agricultural trade; agriculture and land reforms; population structure; and poverty and income distribution.

2.2 Socio-Economic Structure of Bangladesh: An Overview

2.2.1 Emergence of Bangladesh: Historical Background

Bangladesh emerged as an independent country in 1971 following a nine-month long liberation war with Pakistan. The territory that constituted Bangladesh was under Muslim rule for more than five and a half centuries from 1201 to 1757 AD (BBS, 2009c: XVII). It came under British colonial rule in 1757. The British ruled over the Indian sub-continent including this territory for nearly 190 years from 1757 to 1947 (BBS, 2009c: XVII). During this period Bangladesh was a part of the British-Indian province of Bengal and Assam. With the cessation of British rule in August 1947, the Indian sub-continent was partitioned into two independent states – India and Pakistan. Bangladesh formed a part of Pakistan, called East Pakistan. It remained so for about 24 years from 14 August in 1947 to 16 December in 1971 (BBS, 2009c: XVII).

Bangladesh has a geographical area of 147,570 sq km. It is situated in the tropics between 20°-34″ and 26°-38″ North latitudes and between 88°-01″ and 92°-41″ East longitudes. It is located in South Asia at the coast of the Bay of Bengal bordering mainly with India and a small part (Southeast) with Myanmar as shown in Map 2.1.

Map 2.1: Location of Bangladesh in South Asia

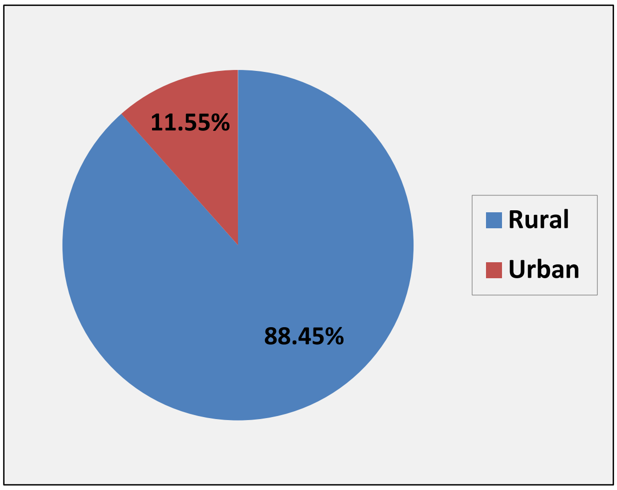
Source: Google. [Online]. [Available]:
http://www.google.co.nz/imgres?imgurl=http://www.allmaps.tk/wp-content/uploads/Political-maps-south-asia-3.jpg&imgrefurl=http://www.allmaps.t [Retrieved: 27 May 2011].

2.2.2 Bangladesh Economy: An Overview

Bangladesh is an agricultural country where more than 80 percent of the population are directly or indirectly dependent on agriculture. It is a rural based economy. The majority of households live in the rural areas. Agriculture is the main source of income and the key sector for employment of rural households. Therefore, agricultural trade liberalisation is an important policy change for the welfare of rural households.

Figure 2.1 presents the importance and dominance of the rural economy in terms of distribution of households. In 2008, 88.45 percent of the total households lived in the rural areas, whereas only 11.55 percent of households lived in the urban areas. This is an important indication that agricultural trade liberalisation directly affected the livelihoods of almost 89 percent of households of the economy. In 2005, the average size of households (as considered the number of members) at the national, rural and urban level was 4.85, 4.89 and 4.72 respectively (BBS, 2007b: vii).

Figure 2.1: Distribution of households by rural and urban areas in Bangladesh: 2008



Source: Author's drawing using data from text of BBS (BBS, 2009a: 9)

As shown in Table 2.1, Bangladesh was one of the most densely populated countries in the world, with a population of 162 million and population density of 1246 people per sq km in 2009. However, it was a very small economy in terms of gross domestic product (GDP) and gross national income (GNI) per capita. GDP is the market value of all final goods and services produced within the boundaries of a country in a year. GNI of a country comprises its GDP together with its income received from foreign countries less similar payments made to foreign countries. GNI per capita is the value of a country's GNI divided by its population. It represents the average income of a country's population. In 2009, GDP of Bangladesh was 89.38 billion US dollars, and GNI per capita was 590 US dollars. The life expectancy at birth was only 66 years, and the adult literacy was very low, only 55 percent. Although there has been remarkable progress in reducing infant mortality since independence in 1971, this figure remained very high – 52 per 1000 live births in 2009.

Table 2.1: Basic development indicators of Bangladesh economy: 2009

Indicators	2009
Land area (sq km)	147570
Population (million)	162
Population density (per sq km)	1229
GDP (billion US dollars)	89.38
GNI per capita (US dollars)	590
Annual growth of GDP (percent)	4.3
Life expectancy at birth (year)	66
Infant mortality (per 1000 live births)	52
Adult literacy (% of 15+ population)	55
Population below national poverty line (latest survey year 2005)	40
Child malnutrition (% of children under 5 years)	42

Source: Data compiled from various tables of World Bank (2011c, 2011d), and BBS (2009c)

Agricultural trade liberalisation and other outward policy measures have contributed to recent economic growth. As shown in Table 2.2, Bangladesh experienced a steady annual growth rate in GDP, around 6 percent, during 2005-2010. Private consumption contributed the highest share of growth in GDP followed by fixed investment. Fixed investment refers to investment in fixed capital or physical assets such as machinery, land, building, transportation and communication infrastructure, vehicle, technology etc. The share of this growth for fixed investment was 1.3 percent in 2010, while private and government consumption expenditure were 7.0 and 0.4 percent respectively. Government consumption expenditure consists of two main components: expenditure on final goods, and wages and salaries. The share of net exports (exports minus imports) in the growth of GDP was 0.8 percent for the same year. Despite the economy performing steadily in the last two decades – 1990-2010, it is still considered a low-income economy and a least developed country (LDC) in terms of per capita income and other development criteria.

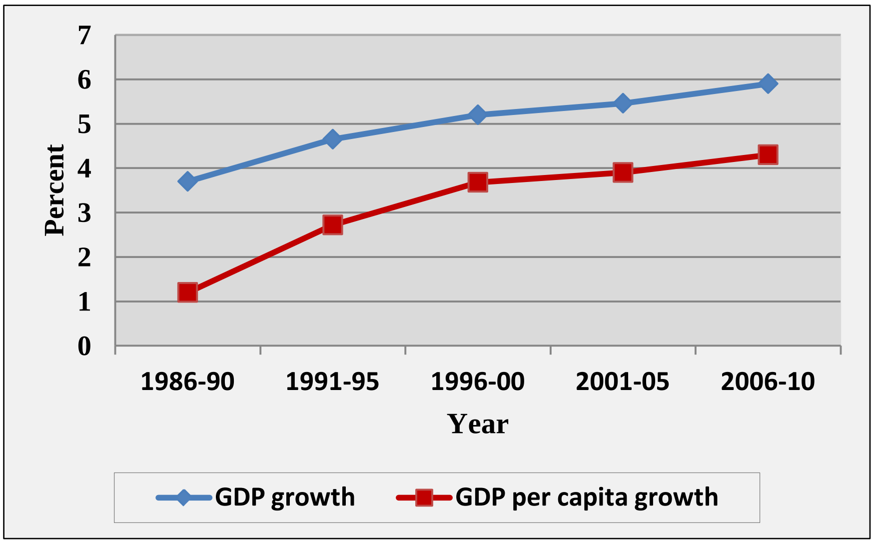
Table 2.2: Basic macroeconomic indicators of Bangladesh: 2005-2010

Indicators	2005	2006	2007	2008	2009	2010*
A. Real Expenditure growth						
1. GDP at market price	6.0	6.2	6.4	6.2	5.7	5.8
2. Real GDP per capita growth	4.0	4.3	4.2	4.4	4.1	4.2
3. Private consumption expenditure	3.9	5.3	5.0	5.7	5.7	5.8
4. Government consumption expenditure	7.8	8.0	9.9	5.0	4.8	6.4
5. Fixed investment	6.8	7.8	7.1	5.1	3.3	5.9
6. Exports	15.6	11.0	8.2	10.0	3.5	2.8
7. Imports	19.1	9.5	7.0	7.0	-2.3	1.4
B. Contribution to GDP growth						
1. Private consumption expenditure	2.9	3.8	3.6	9.3	8.0	7.0
2. Government consumption expenditure	0.5	0.5	0.6	0.3	0.3	0.4
3. Fixed investment	1.7	2.0	1.8	1.2	0.7	1.3
4. Net exports	-1.1	-0.1	-0.1	2.9	1.1	0.8

Note: * estimated data
Source: Data compiled from World Bank database, country data- Bangladesh, April 2009; and Global economic Prospects, Country Forecast: Bangladesh. [Online]. Available: http://web.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTDECPROSPECTS/EXTGBLPROSPECTSAPRIL/0,,contentMDK:20413173~menuPK:659183~pagePK:2470434~piPK:2470429~theSitePK:659149,00.htm [Retrieved: 29 April 2009]; and http://go.worldbank.org/HJUBC9UZI0 [Retrieved: 18 May 2011]

Bangladesh experienced impressive economic and social progress since the early 1990s. It not only experienced steady economic growth but also relatively low inflation as well as sound macroeconomic stability. The average growth rate of GDP in 1986-90 was 3.7 percent and it increased to 5.9 percent during 2006-10 as shown in Figure 2.2. Similarly, the growth performance, coupled with an impressive decline in an average growth rate of population from 2.5 percent in the 1980s to 1.6 percent in 2005-09 (World Bank, 2006: 1; 2011d: 306), led to nearly a quadrupling of annual average per capita GDP growth, from 1.2 percent in 1986-90 to 4.3 percent in 2006-10.

Figure 2.2: Pattern of average annual growth of GDP and GDP per capita

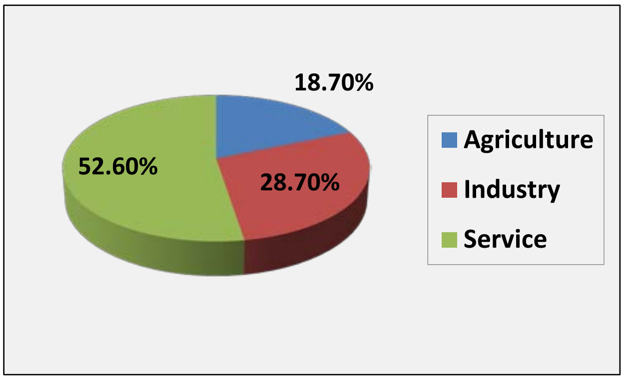


Source: Author's calculation from various tables of (World Bank, 2011c, 2011d); and other World Bank database. [Online]. Available: http://devdata.worldbank.org/AAG/bgd_aag.pdf. [Retrieved: 18 May 2011].

2.2.2.1 Structure of the Economy

Like many other developing countries, agriculture contributed 18.7 percent to GDP in 2010, as shown in Figure 2.3. By the sectoral share of GDP, the service sector contributed the highest share with 52.6 percent followed by industry with 28.7 percent. The service sector consists of the following major sub-sectors: a) construction; b) wholesale and retail trade; c) hotel and restaurant; d) transport, storage and communication (post and telecommunication); e) financial services; f) real estate; g) public administration and defence; h) education; i) health; and j) community, social and personal services.

Figure 2.3: Structure of the economy: sectors share of GDP (in percent): 2010



Source: Author's drawing using data from World Bank (2011c: 194)

Agriculture grew steadily during 1989-99 with an average annual growth rate of 2.8 percent as shown in Table 2.3. The average annual growth rates for industry and service sectors were 7.3 and 4.3 percent respectively over the same period. The average growth rate of agriculture, industry, and the service sector was 3.4, 7.7, and 6.4 percent respectively during 1999-09. Therefore, all three sectors experienced higher growth rates during 1999-09 than that of the previous decade.

Table 2.3: Average annual growth of vital sectors of the economy

Sector	1989-1999	1999-2009	2006	2007	2008*	2009*
Agriculture	2.8	3.4	4.9	3.2	3.2	4.1
Industry	7.3	7.7	9.7	9.5	6.8	6.5
Service	4.3	6.0	6.4	6.7	6.5	6.3

Source: Data compiled from World Bank (2008a: 1) and *World Bank (2011a: 1)

2.2.2.2 Foreign Remittance

Bangladesh is a labour-exporting country. Overseas employment and remittances play a vital role in the economy. The major destinations of export-labour are Saudi Arabia, the USA, the UAE, the UK, Kuwait, Qatar, Oman, Bahrain, Malaysia, and Singapore. As shown in Table 2.4, the number of persons employed overseas increased from 250000 in 2004-05 to 981000 in 2007-08. Large working population but low domestic employment opportunity contributed to this growth of overseas employment. The world economic recession slowed this growth during 2008-09 and 2009-10. The remittances increased from 3.84 billion US dollars in 2004-05 to 11.10 billion US dollars in 2009-10.

Table 2.4: Overseas employment and remittances: 2004-05 to 2009-10

Year	Number of persons in foreign employment (in 000)	Remittance (million US dollars)
2004-05	250	3848
2005-06	291	4802
2006-07	564	5978
2007-08	981	7915
2008-09	650	9689
2009-10	430	11120

Source: Data compiled from Appendix 53, (Ministry of Finance, 2008: 292); and Appendix 53, (Ministry of Finance, 2010: 290)

In 2010, India was the largest remittance recipient country with an amount of 55 billion dollars as shown in Table 2.5. Considering remittance to GDP ratio, Tajikistan was the largest recipient country in the world with a ratio of 35 percent in the same year. Bangladesh received 11.1 billion dollars in remittance that accounted for 11.1 percent of GDP and became the seventh largest remittance recipient country in 2010.

Table 2.5: Remittance flow: Bangladesh, world and top 10 countries: 2010

Top 10 Remittance recipients (total amount) 2010			Top 10 Remittance recipients (percentage of GDP)		Top 10 Remittance Senders (total amount)		Top 10 Remittance senders (percentage of GDP)	
Country	***($b)***	****PC($)***	***Country***	***(%)***	***Country***	***($b)***	***Country***	***(%)***
India	55.0	47.62	Tajikistan	35	USA	48.3	Luxembourg	20
China	51.0	38.32	Tonga	28	S. Arabia	26.0	Lebanon	17
Mexico	22.6	211.21	Lesotho	25	Switzerland	19.6	Oman	10
Philippines	21.3	231.52	Moldova	23	Russia	18.6	Maldives	9
France	15.9	253.99	Nepal	23	Germany	15.9	Kuwait	8
Germany	11.6	141.64	Lebanon	22	Italy	13.0	Bahrain	7
Bangladesh	11.1	68.52	Samoa	22	Spain	12.6	S. Arabia	6
Belgium	10.4	962.96	Honduras	19	Luxembourg	10.6	G-Bissau	5
Spain	10.1	219.57	Guyana	17	Kuwait	9.9	Guyana	6
Nigeria	10.0	64.64	Salvador	16	Netherlands	8.1	Tonga	5
Bangladesh	***11.1***	**68.64**		****11.87***				
World	**440**	**83.35**		**0.75**				

Note: PC – Per Capita Remittance; S. Arabia – Saudi Arabia
Source: Data compiled and calculated (*) from World Bank (2011b, 2011c)

2.2.2.3 Deregulation and Private Sector Development

The private sector played an important role in Bangladesh's economic development during 1990-2010. It contributed to generation of income and employment as well as to poverty reduction. The private sector contributed 19.74 percent to GDP in 2009-10 (Ministry of Finance, 2010: 199). The major sub-sectors that constituted the private sector were textiles, chemical, engineering, service, agro-based firms, food-beverages, glass-ceramic, printing-publication, leather, and miscellaneous in 2009-10 (Ministry of Finance, 2010: 202).

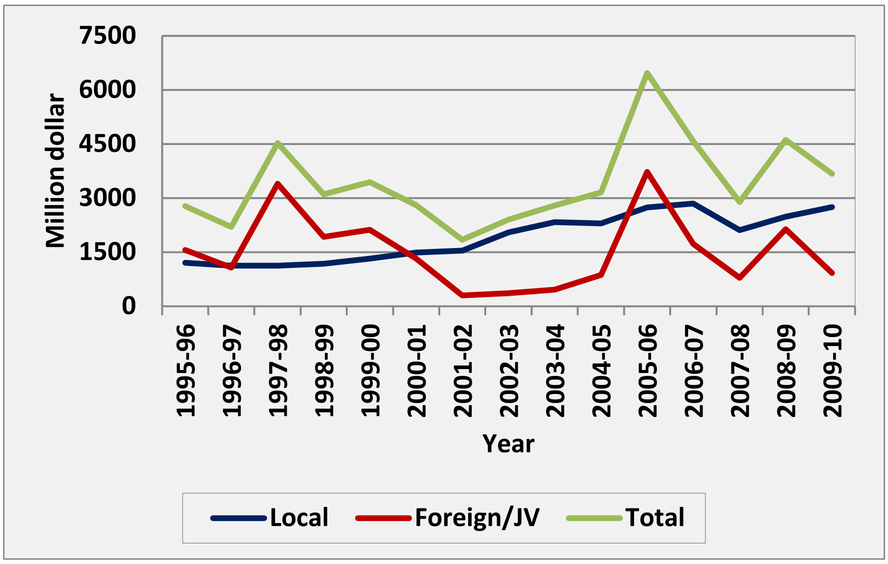
The government has been taking huge steps and measures to reform policies for the development of the private sector since the late 1980s. These policies and measures included development of institutions and infrastructure, reforms in capital markets, keeping open all but reserved sectors for private investment, and no government permission requirements for foreign investors to invest in any sector. In order to attract private investment, the government introduced incentive schemes such as relaxation of the *Foreign Exchange Control Act*, tariff rebates on imported capital machinery for 100 percent export-oriented industries, tax holiday, protection of industrial products through tariff rationalisation, simplification of the raw material import policy and reduction of tariff rates. (Ministry of Finance, 2008: 199).

The government formed the *Board of Investment* and the *Privatisation Commission* for private sector development (Ministry of Finance, 2010: 199). The government established eight export-processing zones (EPZs) at different locations of the country. The EPZs are meant to encourage foreign investment in export-oriented industries. In 2007-08, investors from 33 countries invested in 283 industries that were operating in the EPZs of Bangladesh. They employed 21.82 million Bangladeshi workers (Ministry of Finance, 2008: 200). The important fact is that amongst those workers, 64 percent were female. In 2007-08, the EPZs' export value was 2.825 billion dollars – over 20 percent of total exports (Ministry of Finance, 2008: 200, 289).

The main objectives of these policies and measures were to create an investment-friendly environment in the economy for attracting domestic and foreign private investment (Ministry of Finance, 2010: 199). As a consequence of these policies and measures the total national investment significantly increased during 1990-2010 (Ministry of Finance, 2008: 199; 2010: 201). Total private investment increased from 2114.57 million dollars in 2000-01 to 4552.84 million dollars in 2008-09. In 2008-09, total investment of the economy was 24.16 percent of GDP and the share of private investment covered 79.20 percent of total investment (Ministry of Finance, 2010: 201).

Although local private investment grew very slowly during 1995-96 to 2009-10, the flow of foreign investment experienced high fluctuation over the same period as shown in Figure 2.4. The period 2000-01 to 2005-06 showed a declining trend. This is probably because of political unrest in the country that might have adversely affected foreign investment.

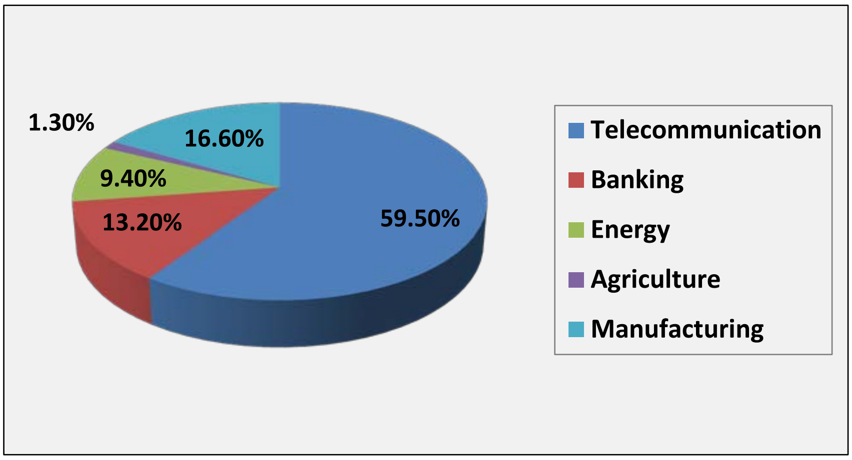
Figure 2.4: Flow of private investment: 1995-96 to 2009-10



Note: Local: Local Private Investment, Foreign: Foreign Private Investment and JV: Joint Venture,
Source: Author's calculation from Table 14.2, Ministry of Finance (2008) and Table 14.2 Ministry of Finance (2010)

Foreign Direct Investment (FDI) is an important component of private investment in Bangladesh. In 2006, FDI accounted for 37 percent of the total private investment – a value of 792.6 million dollars (Ministry of Finance, 2008: 204). The telecommunication sub-sector had the highest share of FDI with 59.5 percent followed by the manufacturing sector with 16.6 percent in 2009 as shown in Figure 2.5. On the contrary, the agricultural sector including fisheries had an insignificant share, only 1.3 percent, in the same year. The contrast in FDI flow between telecommunication and agriculture might be attributed to the government policy – *Vision 2021: Digital Bangladesh,* which emphasised four elements: human resource development, improving people's daily lifestyle through involving them with modern communication technology, improving efficiency of the civil service, and use of information technology in business (Board of Investment, 2011). In addition, the demand for services of mobile phones and satellite television has been growing rapidly since the 1990s, thereby attracting higher private investment in the telecommunication sub-sector.

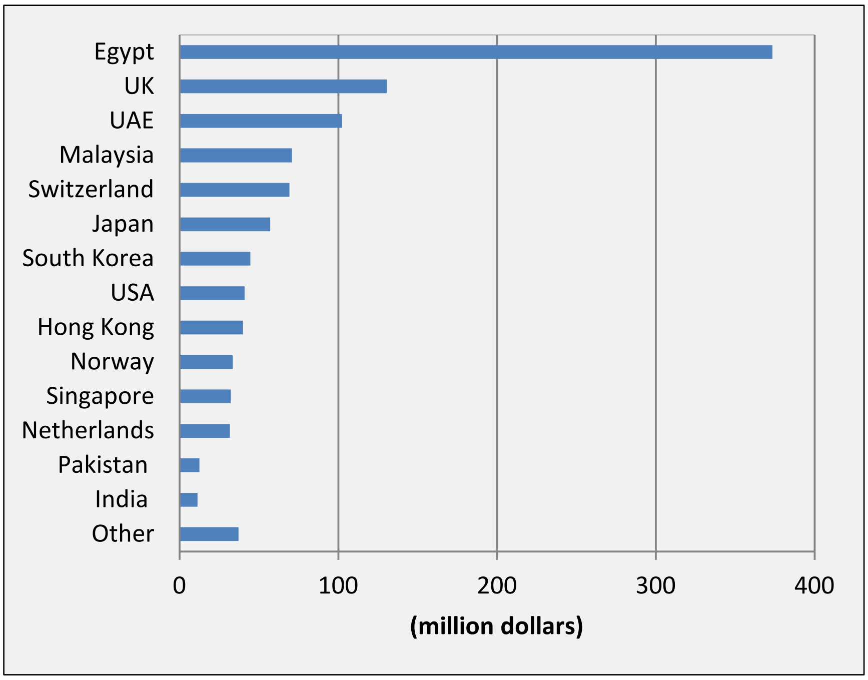
Figure 2.5: Sectoral distribution of FDI: 2009



Source: Author's calculation from (Board of Investment, 2010: 51)

In 2008, Bangladesh received 1086 million dollars in FDI and 96.59 percent of it came from 16 countries (Board of Investment, 2010: 50). These countries are shown in Figure 2.6. Amongst them, the top three countries – Egypt, the UK and the UAE – together invested 55.80 percent of FDI in the same year. Considering the five largest sources of FDI, three developing countries – Egypt, the UAE and Malaysia ranked the first, third and fourth respectively; and two developed countries – the UK and Switzerland – ranked the second and fifth respectively in 2008. Foreign investors from developed countries found investment in Bangladesh risky and insecure because of political violence and instability, thereby leaving significant investment scope for developing countries' investors, resulting in higher FDI flow from developing countries in 2008 (Sen and Mohsin, 2010: 75, 76; Vaughn, 2008: 7). This analysis suggests that developing countries are important sources of Bangladesh's FDI.

Figure 2.6: FDI flow by source of countries: 2008



Source: Author's calculation from (Board of Investment, 2010: 50, 51)

Bangladesh received a relatively low inflow of FDI in terms of percentage share of GDP compared to South Asia, developing countries and the world in 2009 as presented in Table 2.6. Political violence and instability; poor governance, infrastructures and institutions; uncertainty stemming from government inefficiency; politicisation of public administration; corruption of public institutions; and weak enforcement of property rights were the main reasons for low FDI flow (Bénassy-Quéré *et al.*, 2005: 9; Nasrin *et al.*, 2010: 4, 5; Sen and Mohsin, 2010: 75; Vaughn, 2008: 4, 7).

Since independence in 1971, Bangladesh has been experiencing political instability in the forms of frequent changes in government, martial law, and imposition of a state emergency due to political turmoil and violence amongst political parties (Nasrin, *et al.*, 2010: 4; Vaughn, 2008: 4, 7). The military has been either directly running or influencing successive democratic governments since 1975 (Vaughn, 2008: 4, 7). Consequently, foreign investors considered investment in Bangladesh to be risky, insecure and uncertain, resulting in low FDI flow (Sen and Mohsin, 2010: 75, 76; Vaughn, 2008: 7).

Table 2.6: FDI flow in Bangladesh: a comparison, 2009

Year	Inflow (millions of dollars)	% of GDP*
Bangladesh	716	0.80
India	34613	2.51
South Asia	41406	2.44
Developing Economies	478349	2.87
World	1114189	1.91

Source: Data compiled and calculated (*) from Annex Table 2 (UNCTAD, 2010); and Table 4.4 (World Bank, 2011c)

2.3 Government and Administration Structure

The government of Bangladesh is a unitary form by structure and a parliamentary system by democratic feature. The president is the head of state and the prime minister is the head of government.

There are seven administrative divisions (areas) in Bangladesh. They are, namely: Barisal, Chittagong, Dhaka, Khulna, Rajshahi, Rangpur and Sylhet divisions as shown in Map 2.2.

Map 2.2: Location of the seven divisions* of Bangladesh

Note: * Rangpur Division was created on 25 January 2010; it was formerly a part of Rajshahi Division
Source: http://en.wikipedia.org/wiki/Divisions_of_Bangladesh [Retrieved: 27 May 2011]

The divisions are named after the main city of the respective division and the divisional headquarters are located in the main city. Each of these divisions is sub-divided into a number of districts. The district is called Zila. Every district is named after the main district town. Each district's headquarter is located at the main town of a respective district. Similarly, each district is sub-divided into a few sub-districts. The sub-district is called Upazila. Each Upazila is sub-divided into a number of unions. A number of villages constitute a union.

There were 64 zilas and 481 upazilas in Bangladesh in 2007 as shown in Table 2.7. The union – a rural-based administrative unit that may be compared to a municipality in the urban area – is the bottom unit of administration in Bangladesh. It is a form of local government. According to the Bangladesh Bureau of Statistics database, there were more than 80000 villages in the country in 2007. There were seven city corporations located at each divisional headquarters of seven divisions. The Mayor is the head of a city corporation, which has an administrative jurisdiction over the city.

The Divisional Commissioner is the administrative head of a division having jurisdiction over all rural and urban areas such as all unions, upazilas, and zilas of a division.

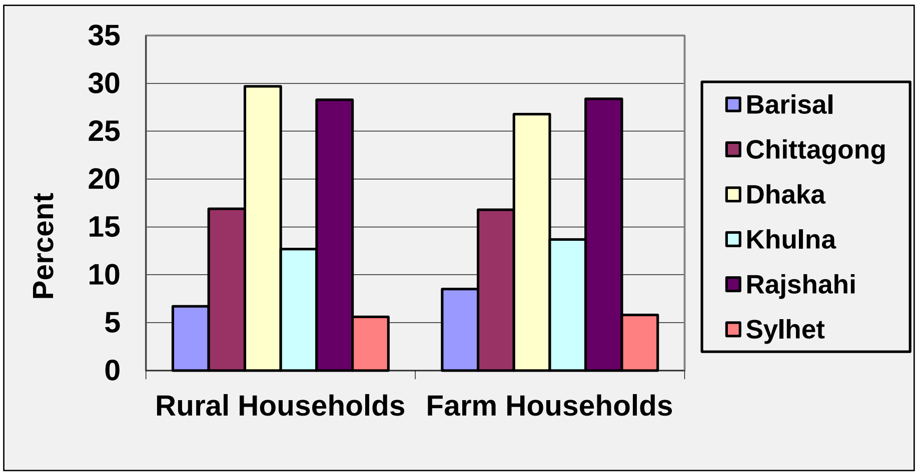
Table 2.7: Administrative units of Bangladesh: 2007

Units	Numbers
Division	7
Zila (District)	64
City Corporation	7
Municipalities	308
Upazila (Sub-District)	481
Union	4498

Source: Compiled from Table 14 (BBS, 2009b: 6).

The important fact is that the distribution of rural and farm households was uneven across the six divisions of the country in 2008 as shown in Figure 2.7. Although, there is a variation in the size of land amongst the six divisions, the concentration of rural households in Dhaka and Rajshahi divisions is clearly evident. In 2008, Dhaka and Rajshahi divisions jointly covered almost 60 percent of rural and farm households because of their relatively large size of land areas as well as concentration of rural activities, followed by Chittagong division with more than 15 percent of each category of households. The other three divisions, namely, Khulna, Barisal, and Sylhet jointly represented about 25 percent of both groups of households. Therefore, the impacts of agricultural trade liberalisation might have varied across geographical divisions depending on the intensity of farming activities and technological adoption that resulted from agricultural trade liberalisation.

Figure 2.7: Distribution of rural and farm households by division: 2008



Source: Author's calculation from Table 3.1 and Table 3.5 (BBS, 2009a)

2.4. Agricultural Trade Liberalisation, Trade Structure and Agricultural Trade

The agricultural trade policy regime in Bangladesh may be divided into three distinct phases as shown in Table 2.8. *Phase-1* was characterised as severe controls over imports of agricultural inputs during 1972-80. The government started trade reforms in *Phase-2* during 1981-90. Substantial trade liberalisation in the agricultural sector happened in *Phase-3* during 1990-02. During 2003-2010, the government continued to follow trade liberalisation policies in line with the agreements signed with the World Trade Organisation (WTO) (Ministry of Finance, 2010: 71).

Table 2.8: Bangladesh agricultural trade policy regime summary: 1972-2002

Phase-1 (1972-1980)	Phase-2 (1981-1990)	Phase-3 (1991-2002)
Severe agricultural trade controls on both exports and imports, including non-tariff barriers (NTBs) and heavy duties, often prohibitive; fixed exchange rate system, with considerable over valuation Massive nationalisation, price control, and control of agricultural inputs and marketing	Initial phase of trade reforms with some relaxation of NTBs and tariff barriers, creation of trade liberalisation environment Initial period of denationalisation, deregulation and removal of price controls, significant liberalisation of agricultural sector - input and output markets	Substantial liberalisation of agricultural trade and investment, and opening up with large reduction of NTBs and average tariffs, shift from fixed to flexible exchange rate system Further progress with privatisation of agricultural input procurement and distribution system, initiative for deregulation measures to improve investment climate for private enterprises

Source: Compiled from Table 1 (Ahmed and Sattar, 2004: 11)

Substantial trade liberalisation policies and measures in the early 1990s significantly increased Bangladesh's integration into the world market. As a result of these policies and measures, Bangladesh's trade integration as measured by its trade to GDP ratio increased from 18 percent in 1989-90 to over 30 percent in 2001-02 (Ahmed, *et al.*, 2007: 3; Ahmed and Sattar, 2004: 18; Hoque and Yusop, 2010: 39; Ministry of Finance, 2009: 68). This ratio increased to 47.6 percent in 2009-10 as shown in Table 2.9.

Table 2.9: Trend in trade of Bangladesh: 2004-05 to 2009-10

(in millions of dollars)

	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10
Total trade (Exports + Imports)	20750	25272	29353	35740	38072	38310
Exports	7603	10526	12178	14111	15565	15388
Imports	13147	14746	17175	21629	22507	22921
Trade to GDP ratio (%)	33.0	36.0	41.0	45.0	45.7	47.6

Source: Author's calculation from various tables (Ministry of Finance, 2008, 2010); and WTO trade data, October 2008

Driven by the desire for export-led development, Bangladesh began expanding its exports towards industrialised countries with basic agricultural products and labour-intensive manufactured exports. As shown in Table 2.10, by main destinations of export, Bangladesh's major trade partners were in developed countries such as the European Union and the United States. However, both developed and developing countries were equally important for the origin of imports of this country.

Table 2.10: Ranking five major trading partners of Bangladesh: 2009

		Rank-1	Rank-2	Rank-3	Rank-4	Rank-5
Exports	***Country***	EU	USA	India	Canada	China
	% of Exports	51.1	25.7	4.0	3.5	1.7
Imports	***Country***	China	India	EU	Kuwait	Indonesia
	% of Imports	15.6	13.2	9.7	7.2	5.1

Source: Compiled from WTO database files, March 2011. [Online]. Available: http://stat.wto.org/CountryProfile/WSDBCountryPFView.aspx?Language=E&Country=BD. [Retrieved: 19 May 20011].

Considering the merchandise and commercial service trade of Bangladesh, the volume of imports was greater than the volume of exports in 2009, which reflected that Bangladesh was a net importer as shown in Table 2.11. In 2009, the manufacturing sector dominated both the total merchandise exports and imports with the share of 87.6 and 61.4 percent respectively. The agricultural sector covered a significant amount of merchandise imports with a share of 25.5 percent. However, its share in merchandise exports was small – only 10.2 percent.

Table 2.11: Commodity composition of Bangladesh's trade: 2009

Merchandise Trade (MT)		Commercial Service Trade (CST)	
MT Exports f.o.b. ($millions)	15083	CST Exports f.o.b. ($millions)	935
MT Imports c.i.f. ($millions)	21833	CST Imports c.i.f. ($millions)	3203
Share of Merchandise Trade exports and imports by main commodity groups			
	Exports (%)		**Imports (%)**
Agricultural products	10.2	Agricultural products	25.5
Fuel and mining products	2.2	Fuel and mining products	13.1
Manufactures	87.6	Manufactures	61.4
Share of Commercial Services Trade exports and imports by main service item			
	Exports (%)		**Imports (%)**
Transportation	15.2	Transportation	82.9
Travel	7.4	Travel	7.8
Other Commercial services	77.4	Other Commercial services	9.3

Source: Compiled from WTO trade data, March 2011. [Online]. Available: http://stat.wto.org/CountryProfile/WSDBCountryPFView.aspx?Language=E&Country=BD. [Retrieved: 19 May 2011].

Agricultural trade liberalisation contributed to a significant increase in rice production. In Bangladesh, rice is produced mainly for domestic consumption. It is a non-exported good. Although Bangladesh achieved self-sufficiency in rice production, it imported a substantial amount of rice for food security and price stability during 2003-04 to 2008-09, as shown in Table 2.12. The major agricultural commodities for exports include raw jute, jute product, tea, and frozen food such as fish and shrimp. On the other hand, Bangladesh imports wheat, oil and oilseeds, raw cotton and rice.

Table 2.12: Value of exports and imports by major agricultural commodities (in million US dollar)

	Year					
	2003-04	**2004-05**	**2005-06**	**2006-07**	**2007-08**	**2008-09**
Exports Commodities						
Raw jute	82	80	148	147	165	148
Jute goods	257	246	361	321	318	320
Tea	15	16	12	7	15	12
Frozen food	322	390	459	515	534	300
Other agricultural products	43	67	154	163	273	194
Total Exports	**719**	**799**	**1134**	**1153**	**1305**	**974**
Imports Commodities						
Wheat	287	312	301	401	537	643
Oilseeds	73	86	90	106	136	159
Edible oil	417	440	473	583	1006	865
Raw cotton	583	666	742	858	1213	1291
Rice	144	262	117	180	874	239
Total Imports	**1504**	**1766**	**1723**	**2128**	**3766**	**3197**

Note: Agricultural inputs, such as fertiliser, irrigation equipment etc., are not included with imports.
Source: Data compiled from Ministry of Finance (2009: 289, 291); and Appendix 49 Ministry of Finance (2010)

2.5 Agriculture and Land Structure

2.5.1 Bangladesh Agriculture

Bangladesh achieved considerable progress in productivity improvement in the agricultural sector through technological transformation as a result of agricultural trade liberalisation during 1990-2010. The agricultural sector consists of the following sub-sectors: crops, forests, fisheries, and livestock. It is an important sector of the economy for providing the rural households with employment and income. More than 80 percent of the population are involved directly or indirectly in a wide range of agricultural activities. Agriculture played an important role in the economy by contributing 23.50 percent to GDP and more than 60 percent to the total national employment – the bulk of the workforce of the country in 2008, as shown in Table 2.13.

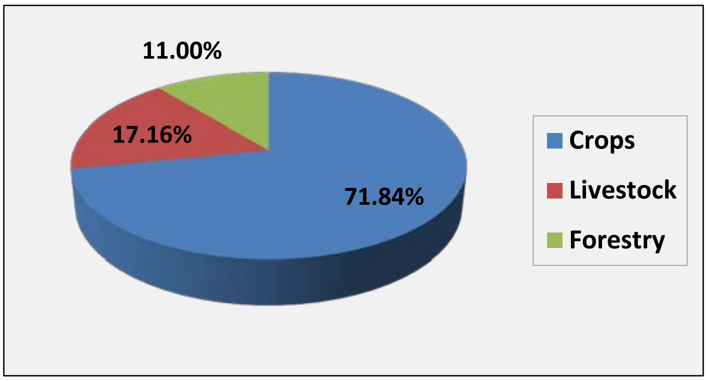
Table 2.13: Bangladesh agriculture at a glance: 2008

Total agricultural households (million)	17.60
Total agricultural land area (million hectare)	14.85
Forests (million hectare)	2.60
Cultivable land (million hectare)	8.29
Cropping intensity (percent)	180
Total cropped area (million hectare)	14.11
Contribution of agriculture to GDP (percent)	23.50
Contribution of crop sector to GDP (percent)	13.44
Manpower in agriculture (percent)	62
Total food crop demand (million tonnes)	23.03
Total food crop production (million tonnes)	27.79
Net food crop production (million tonnes)	25.10
Food surplus (million tonnes)	1.97

Source: Compiled from (a) Ministry of Agriculture (2011), and (b) BBS (2009a)

Like many other developing countries, agriculture is an important sector in Bangladesh. It is the source of staple food for a population of more than 162 million. The crop sub-sector covered 71.48 percent of the total agricultural share in 2008-09 followed by livestock and forestry with shares of 17.16 and 11 percent respectively, as shown in Figure 2.8. Rice accounted for 75 percent of the total crop production value and 63 percent of the total crop sale. It captured nearly 80 percent of the cultivated area in Bangladesh in 2005 (Klytchnikova and Diop, 2006: 13). Moreover, rice is the single most important consumption item of both rural and urban households.

Figure 2.8 : Percentage share of sub-sectors of agriculture: 2008-09



Source: Author's calculation from Appendix: 5, Ministry of Finance (2010)

Rice, wheat and maize are the main food-grains in Bangladesh. Amongst them, rice is the most dominant crop because it is the staple food. Rice accounted for 93.5 percent of total food-grain production in 2008-09 as shown in Table 2.14.

Table 2.14: Food-grain production: 2009-10

Foodgrain	Production (000 tonnes)	% of total production*
Rice	34560	93.57
Wheat	1006	2.72
Maize	1370	3.71
***Total**	**36936**	**100**

Source: Data compiled and *calculated from Table 7, Ministry of Finance (2010)

The main cash crops in Bangladesh were jute, potato, sugarcane, tea and tobacco in 2008-09 as shown in Table 2.15. Cash crops covered a very small part of agricultural production. This is because of the fact that small and subsistence farmers are dominant in agriculture and they are mainly engaged in food-grain production for household consumption.

Table 2.15: Cash crop production: 2008-09

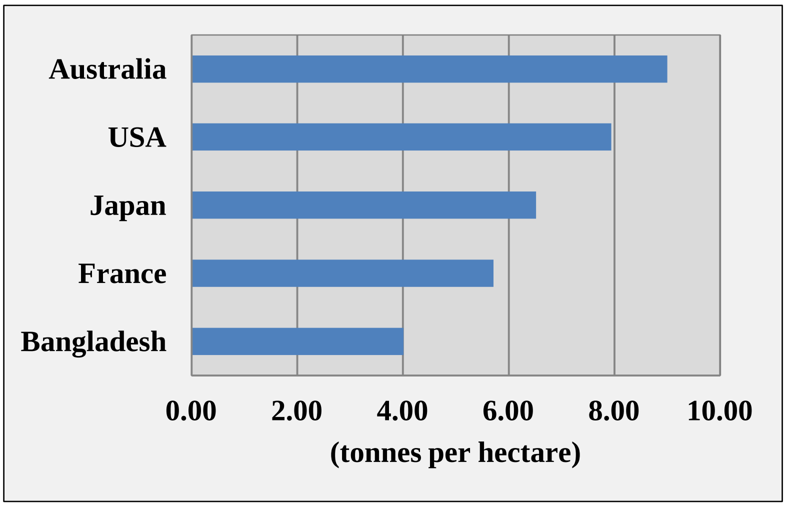
Crops	Production (000 tonnes)
Jute	847
Potato	5268
Sugarcane	5233
Tea	58
Tobacco	80

Source: Data compiled from Appendix 27, Ministry of Finance (2010), and BBS database

Small farm size and subsistence farming are the basic characteristics of Bangladesh's agriculture. Studies showed that only 1.20 percent of rural households run commercial farms (BBS, 2007b: 5). Agricultural trade liberalisation contributed to a significant technological transformation in the agricultural sector through adoption of high yielding varieties (HYV) of rice, wider use of fertilisers and pesticides, and application of modern irrigation equipment. However, agriculture in Bangladesh remained at the traditional stage in terms of cultivation procedure and harvesting systems. Although, there is a trend to use power tillers, farmers use traditional ploughing such as bulls, shovel and spade in preparing the land for cultivation. Almost 100 percent of harvesting takes place manually with primitive instruments such as sickle and scythe (Ministry of Agriculture, 2007).

Despite significant progress in agricultural production, the productivity of farms in Bangladesh is relatively low in comparison with that of developed countries. This is partly because of the primitive cultivation system in Bangladesh's agriculture. In 2009, the yield of rice in Bangladesh was only 4.01 tonnes per hectare; whereas, this figure in Australia was 9.00 tonnes, followed by the USA, Japan and France with 7.94, 6.52 and 5.71 tonnes respectively as shown in Figure 2.9.

Figure 2.9: Yield of rice in Bangladesh and some selected countries: 2009



Source: Author's calculation from International Rice Research Institute (IRRI) database [Online]. Available: http://geo.irri.org:8180/wrs/ [Retrieved 20 May 2011)

Although Bangladesh is still far behind in terms of average rice production per hectare compared with both developed and some developing countries, it claimed a higher average production of rice than some South-Asian countries such as India and Pakistan, and even higher than that of Thailand in 2001, 2002 and 2009 as shown in Table 2.16.

Table 2.16: Average rice yield per hectare in selected countries (in tonnes)

Country	2001	2002	2009
China	4.10	4.17	6.59
Vietnam	2.84	2.90	5.23
Bangladesh	**2.28**	**2.34**	**4.01**
India	2.08	1.94	2.98
Pakistan	1.83	1.92	3.58
Thailand	1.79	1.73	2.87

Source: Author's calculation from Table 3.09, Ministry of Agriculture (2007); and International Rice Research Institute (IRRI) database [Online]. Available: http://geo.irri.org:8180/wrs/ [Retrieved: 20 May 2011)

The structure and distribution of rural households reflects the situation of agriculture and the rural economy. As the number of rural non-farm households increases, the number of farm households decreases. Table 2.17 illustrates that non-farm households increased from 33.82 percent in 1996 to 48.82 percent in 2008. On the contrary, the number of farm households decreased from 66.18 to 51.33 percent over the same period. Similarly, the number of agricultural labourer households decreased from 35.91 percent to 31.13 percent during that period.

Table 2.17: Percentage distribution of rural households in Bangladesh

Type of Households (%)	1996	2005	2008
Non-farm households	33.82	40.82	48.67*
Farm households	66.18	59.18	51.33
Agricultural labourer households	35.91	28.64	31.13

Source: Compiled and calculated (*) from Table T02, BBS (2005); and BBS (2009a)

It is argued that this trend of change in the distribution of rural households is a direct result of decreasing agricultural resources, the growing population and lack of cultivable land. World Bank (2004b) argued that some of the agricultural labourers switched from agriculture to non-farm activities because of higher wages in the non-farm sector.

Although agricultural trade liberalisation improved agricultural productivity significantly, there is a growing consensus that this is starting to fall gradually. Some studies such as Ahmed and Sattar (2004), and Balcombe *et al.*(2007) found clear evidence that the productivity of agriculture was in a declining trend. They argued that with the existing technology and production system, there would be little scope to further expand the production possibility frontier of Bangladesh's agriculture.

It is suggested that besides conventional inputs (irrigation equipment, fertilisers, pesticides and HYV seeds), non-conventional variables such as farmers' education, access to credit and improved agricultural extension services may play a significant role in increasing agricultural productivity. Moreover, the traditional cultivation system is a major hindrance to productivity improvement. Therefore, agricultural reform through modernisation is an alternative option to increase productivity and efficiency in the agricultural sector.

2.5.2 Land Structure and Land Reforms

Bangladesh achieved significant progress in liberalising agricultural input markets. Agricultural trade liberalisation improved productivity by diffusion of modern technology in agriculture. However, land – an important factor of production – posed a significant problem in modernisation of the agricultural sector. The impact of agricultural trade liberalisation on productivity improvement is highly dependent on the characteristics of land and farm-size. It is argued that land is the basic source of income and employment for rural households. Land is a scarce resource in Bangladesh where the land and person ratio is very low (Rahman and Rahman, 2009: 95). Like many other developing countries, sub-division and fragmentation of land is a basic characteristic of agriculture in Bangladesh. More than 50 percent of rural households were functionally landless in 2002 (Khan, 2004: 85; Rahman and Rahman, 2009: 96). As shown in Table 2.18, the national average farm size was 0.81 acre in 2008. This figure for rural and urban areas was 0.86 and 0.40 acre respectively.

Table 2.18: Structure of farm and non-farm households in Bangladesh: 2008

	National	Urban	Rural
Farm household (% of total households)	51.33	1.15	50.18
Non-farm household (% of total households)	**48.67**	**10.41**	**38.26**
Absolute landless (% of total households)	15.62	36.83	12.84
Agricultural labourer (% of total households)	31.14	0.27	30.86
Average operated land (farm size) per household (acre)	0.81	0.40	0.86
Average owned land per household (acre)	0.79	0.40	0.85
Average cultivated land per farm household (acre)	1.02	0.72	1.15

Source*:* Compiled and calculated (bold) from various tables of BBS (2009a)

Although agricultural trade liberalisation has facilitated diffusion of modern technology in agriculture, leading to significant productivity improvement, the existing characteristics of land, land tenure and management systems are the main barriers towards modernisation of agriculture. Therefore, land reform is a fundamental issue of the economy.

Land reform refers to the changes in the pattern of ownership rights and land tenure system. Since independence in 1971, land reform in Bangladesh has been regarded as an important issue but very little initiative has been undertaken to resolve it due to its political sensitivity. Careful review reveals that this fundamental issue has been ignored by successive governments in order to patronise the urban elites who are basically absentee landlords but are powerful enough to influence government's policy (Taslim, 1993: 341). Although the government initiated land reforms in 1983 and undertook some measures such as lowering the land-holding ceiling to 33 acres, these measures were considered inadequate because the rural community did not benefit from them due to the weakness and limitations in policy framework, and a bias towards the urban elite.

The argument for land reform is most persuasive when proposed land reform promises not only to improve distribution but also to increase growth and efficiency (Khan, 2004: 73). Effective land reform is necessary to improve distribution, productivity and efficiency. The real constraints to productivity-enhancing changes come from the distribution of power amongst factions engaged in primitive accumulation of land (Khan, 2004: 77). It is argued that land reforms can bring about multiple benefits such as redistribution of productive wealth and can: (a) improve the distribution of income and reduce rural poverty directly; (b) help to increase efficiency in the use of resources, thereby raising the level of output and average income; (c) increase employment opportunities; (d) weaken the system of labour control; and (e) help the agricultural sector accelerate the rate of growth (Griffin *et al.*, 2004: 367).

There is considerable debate on the land reform issues of Bangladesh. Devine (2002), and Griffin *et al.* (2004) argued for redistribution of land in order to bring about reallocation of productive resources in rural areas. This advocacy is based on a neo-classical approach, which argues that redistribution of land can increase productivity of the agricultural sector and improve income distribution of rural households by reducing inequality.

Griffin *et al.* (2004) further argued that the concentration of land ownership might be an important source of rural inequality, and the land concentration was very high in Bangladesh compared to many Asian countries, as shown in Table 2.19. Amongst the selected Asian countries, Bangladesh captured the highest Gini coefficient (0.65), indicating the highest land concentration. This demonstrates that there is ample scope for redistribution of land in Bangladesh.

Table 2.19: Land concentration in selected Asian developing countries

Country	Year*	Gini Coefficient
South Asia		
Bangladesh	1995	0.65
India	1981-90	0.59
Pakistan	1981-90	0.58
Southeast Asia		
Indonesia	1971-80	0.56
Malaysia	1971-80	0.58
Philippines	1980	0.61
East Asia		
China	1995	0.43
South Korea	1971-80	0.30
Taiwan	1961-70	0.47

Note: * latest available data for that country during study
Source: Compiled from (Griffin, *et al.*, 2004: 323)

Table 2.20 shows that, during 1983-84 to 1996-97, the land ownership did not change much. Although there was a slow declining trend in the number of large and medium farmers, they owned and operated 73.8 and 76.6 of total land respectively, but they represented only 16.9 percent of farm households in 1996-97. On the contrary, in the same period, small farmers represented 83.1 percent of the total farm households but operated only 23.3 percent of land that was less than the land they actually owned (26.2 percent).

Table 2.20: The size and distribution of land in Bangladesh: 1983-84 to 1996-97

Size of holding (acre)	1983-84			1996-97		
	Frequency (%)	Owned area (%)	Operated area (%)	Frequency (%)	Owned area (%)	Operated area (%)
Small (0.05-2.49)	75.4	18.2	14.8	83.1	26.2	23.3
Medium (2.50-7.49)	19.9	56.2	59.3	14.3	56.3	59.3
Large (7.50 +)	4.7	25.6	25.9	2.6	17.5	17.3

Source: Compiled from Table 2 (Khan, 2004: 86)

Land fragmentation is considered a significant impediment to efficient crop production in Bangladesh. It is a serious barrier towards modernisation and mechanised farming. Agricultural trade liberalisation has facilitated technological transformation in agriculture but modernisation and mechanised farming is largely obstructed by land-size and fragmentation. Although many countries around the world have implemented policies encouraging land consolidation, Bangladesh failed to resolve this issue. Fragmentation of farms is a major reason to use more labour and other resources, leading to inefficiency because these resources could be used more effectively elsewhere in the economy (Hung *et al.*, 2007: 195; Rahman and Rahman, 2009: 100). Fragmentation and subdivision also results in high production costs in the agricultural sector (Rahman and Rahman, 2009: 100). Thus, the farm gate price as well as the margin for the farmer (price over variable cost) is substantially higher in Bangladesh compared to other similar countries such as Thailand and Vietnam. Thai farmers can offer rice at a lower margin to consumers because of the considerably large farm size compared to other rice-growing countries in Asia. The average farm size in Thailand is more than 12.355 acres compared to 0.68 acre in Bangladesh (Hossain and Deb, 2003: 6; Rahman and Rahman, 2009: 95).

An important aspect of land is related to its administration and management. In Bangladesh, land administration and management is based on a complicated operation system. The registration and survey of land is administered under the jurisdiction of the Ministry of Law, whereas the Ministry of Land executes collection of revenue, land mutation, and khas land management (government owned land) including acquisition of land. Similarly, the procedure for resolving disputes over land ownership is the jurisdiction of the three different authorities: Ministry of Land, Ministry of Law, and the High Court. Consequently, it takes a long time to resolve disputes due to the opaque and complex assembly of processes and procedures. Although all activities related to land including civil litigations are conducted under the provision of the *"State Acquisition and Tenancy Act - 1950"*, the land administration and management system in Bangladesh is considered inefficient due to its complicated nature, multi-authorities and lack of coordination amongst the ministries. An interesting fact is that all three authorities hold legal authority to amend the land ownership records (title), thereby creating many owners of a single plot of land, making the land ownership pattern more complicated and leading to a huge number of disputes and litigations. Consequently, land ownership and property-right patterns became very complicated and unclear. An inefficient land management system is a critical barrier to land consolidation and land transfer, making future land reform prospects and initiatives more uncertain.

Despite strong public repercussions against this land management system and a high demand for reforms to improve the system and bring all land-related procedures under the jurisdiction of a single ministry, government initiatives to resolve this issue are few. For example, in the late 1980s, the government abandoned the land reform agenda in favour of promoting vocational training and education, and providing research and extension services to agriculture for more rapid diffusion of higher-yielding crops (Taslim, 1993: 341).

Maximising benefits from agricultural trade liberalisation may depend on basic conditions such as characteristics of land, the land tenure system as well as land administration and management. Addressing these conditions may help transform agriculture into a modern farming sector through technological innovation. Therefore, comprehensive land reform is necessary for this transformation, facilitated by agricultural trade liberalisation. In addition, secure and equitable access to land is an important aspect of pro-poor growth policy. Similarly, secure property rights and efficient land administration are crucial for pro-poor agricultural growth.

2.6 Population Structure

The Bangladesh population was 162.2 million in 2009 as presented in Table 2.21. This is quite a large population for its small land area (147570 sq km), resulting in a very high population density – 1229 people per square kilometre. The World Development Report 2011 showed that it was the most densely populated country (except city-states such as Hong Kong and Singapore) and the eighth most populous country in the world. The significant fact is that this density is nearly 24 times greater than the world's average population density (52 per sq km) and 3.79 times higher than that of South Asia (324 per sq km) (World Bank, 2011d: 306, 307). Despite significant progress in a reduction of population growth from 2.88 in the 1980s to 1.6 percent in 2000-09, it was much higher than the world average growth rate of 1.2 percent (World Bank, 2011d: 307).

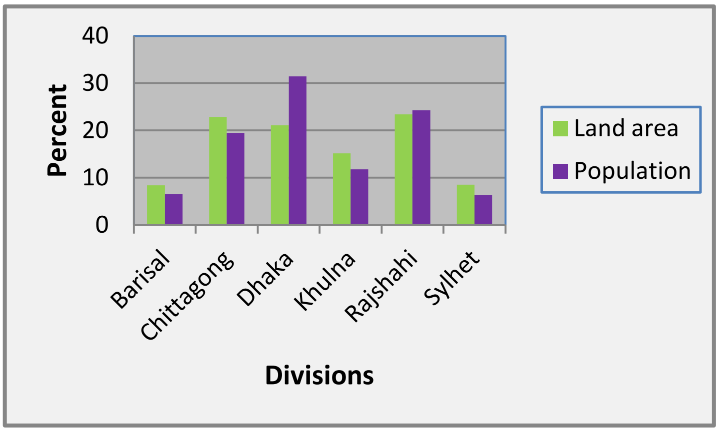
Table 2.21: Basic facts about the population of Bangladesh and South Asia

	2009	
	Total	***Percent***
Total population (million)	162.2	100
Male (million)	**82.07**	**50.6**
Female (million)	**80.13**	49.4
Urban (million)	**45.4**	**28**
Rural (million)	**116.8**	72
	Bangladesh	***South Asia***
Average annual growth (2000-09)	1.6	1.6
Sex ratio (males per 100 female)	**102**	**106**
Life expectancy at birth (year)	**67**	**65**

Source: Data compiled and calculated (bold) from Table 1.5, 2.1, 2.2 and 3.1 of World Bank (2011c), and Table of World Bank (2011d)

The percentage distribution of population amongst the six geographical divisions of Bangladesh is not proportional to their land areas as illustrated in Figure 2.10. Dhaka Division had the highest concentration of population amongst the six divisions in 2007. Its land area was around 20 percent of the total land but the proportion of its population was more than 30 percent of the total population of the country. Amongst six divisions, only Rajshahi had a population distribution that was proportional to its land area. All of the other four divisions, namely, Barisal, Chittagong, Khulna, and Sylhet had a smaller proportion of population than the respective size of their land areas.

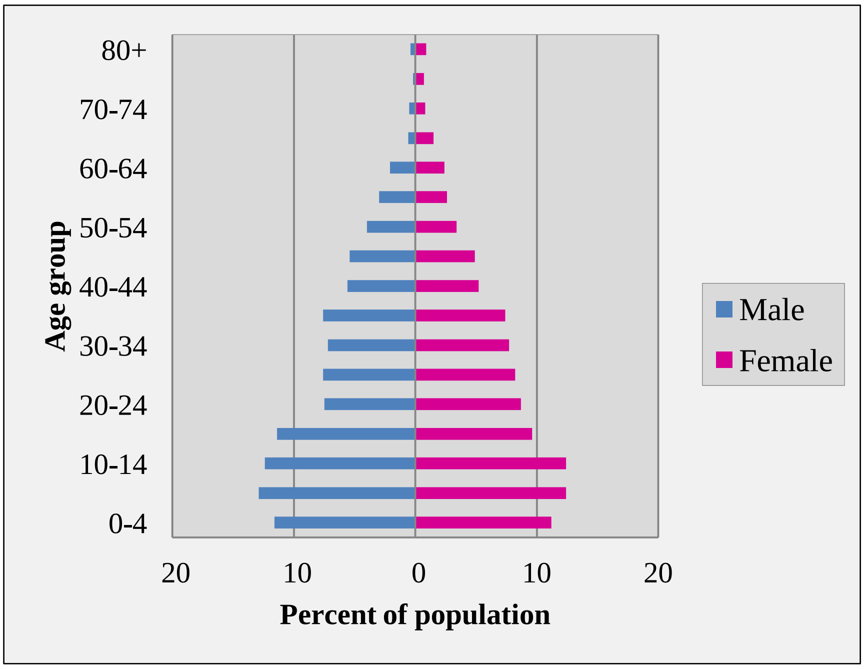
Figure 2.10: Distribution of population and land area by division: 2007



Source: Author's calculation from Bangladesh dataset 2007 (section 2.6), BBS database

The population distribution by age group is shown in the population pyramid (Figure 2.11). The pyramid consists of two halves – the male and female population – showing almost symmetric distribution starting from the first to the last age group in 2005. The first age group (0-4) was smaller than the second age group (5-9) indicating that the population growth was decreasing.

Figure 2.11: Population pyramid, 2005*



Note: * Latest Household Income and Expenditure Survey (HHIES) 2005 by BBS
Source: Author's drawing using data from Table 2.6, BBS (2007b); and section 2.1, Bangladesh data sheets 2007, Bangladesh Bureau of Statistics

The population distribution by three broad age groups is presented in Table 2.22. In 2005, both school age and working age groups were large, consisting of 36.5 and 58.5

percent of the population respectively. Conversely, retirement age population was small – 5.1 percent, indicating that the population was young in Bangladesh in the same year. The population structure suggests that the government should invest more in education than in healthcare and generate employment opportunities for the working age population who will contribute to high economic growth.

Table 2.22: Distribution of population by three broad age groups: 2005

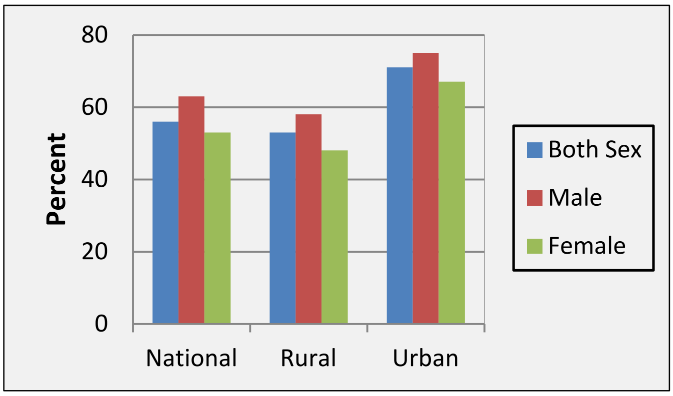
	Percent of population		
Broad age group	**Male**	**Female**	**Both sexes**
School age: 0-14	36.9	36.0	36.5
Working age: 15-59	59.3	57.7	58.5
Retirement age: 60+	3.8	6.3	5.1

Source: Author's calculation from Table 2.6, BBS (2007b)

Figure 2.12 shows the distribution of adult literacy of the population in 2007. It is evident that the male population had higher adult literacy rate than the female for all three categories – national, rural, and urban populations. The national adult literacy rate was around 55 percent and this figure for rural and urban population was around 52 and 71 percent respectively.

This analysis suggests that there is a discrepancy between male and female education in Bangladesh because parents have preferences for male's education over female's due to socio-economic reasons such as illiteracy and poverty of the parents (who cannot afford education for all children) as well as their dependence on sons, not on daughters, during their old age. Similarly, there is a disparity in education between urban and rural areas because there are relatively large numbers of schools in urban areas and educated households tend to live in urban areas for their livelihoods.

Figure 2.12: Adult literacy (population 15+ years): 2007



Source: Author's calculation from section E, Key Indicators on Report of Sample Vital Registration Survey 2006 & 2007, Bangladesh Bureau of Statistics.

2.7 Poverty, Income Distribution and Inequality

Despite Bangladesh's impressive economic growth (average more than 5 percent) over 1990-2010, the decline in poverty over the same period was relatively insignificant – less than 1 percent annually, far below the overall GDP per capita growth rate of 3.4 percent during the same period (CPD, 2008: 1; 2010: 2; World Bank, 2004a: 1; 2011c: 194). It is argued that inequality and uneven distribution of income saw the benefit of economic growth go to the rich rather than the poor (CPD, 2008: 1).

Bangladesh is considered one of the poorest countries in the world. More than 40 percent of the population lived below the national poverty line in 2005 (BBS, 2007b: 57). National poverty line refers to the upper poverty line – consumption expenditure on food for nutritional requirement of 2122 kilocalories per capita per day plus a similar amount of non-food expenditure (BBS, 2007b: 55, 56). The causes and dynamics of poverty of Bangladesh are based on a complex scenario. There are considerable variations and mobility amongst the poor. Although, some economists such as Sen (2007) and Khandker *et al* (2006) argued that fewer opportunities for access to assets kept the poor in chronic poverty. This argument presents only a partial analysis of the issue. Even geographical variation matters significantly in understanding the poverty of Bangladesh. Moreover, factors like natural disasters (such as floods, cyclones, droughts etc.), illness, and insecurity make the poor more vulnerable.

Ravallion and Sen (1996) argued that methods mattered significantly in measuring poverty in Bangladesh. Bangladesh Bureau of Statistics (BBS, 2007b: 56) calculated poverty lines during HHIES - 2005 on the basis of *Cost of Basic Needs* (CBN) method. In the CBN method, poverty lines are calculated to represent the level of per capita expenditure required to meet the basic nutritional requirements, including an allowance for non-food consumption. Firstly, a food poverty line is established to calculate an amount necessary to meet the basic food requirement. Then a non-food allowance is added. The food poverty line was estimated based on expenditure to meet the nutritional requirement of 2122 kilocalories per capita per day. The lower poverty line corresponds to the extremely poor households whose total expenditure on food and non-food is equal to the food poverty line (BBS and WFP, 2004: 2). Therefore, the lower poverty line represents a smaller food intake than 2122 kilocalories. Similarly, the upper poverty line adds an amount of non-food expenditure (such as expenditure on housing, education, clothing etc. – close to the food poverty line) of households whose food expenditure is equal to the food poverty line (BBS, 2007b: 55, 56). Therefore, the upper poverty line corresponds to moderately poor households.

There is a strong negative correlation between poverty and the size of land ownership in Bangladesh. Table 2.23 shows that an increase in the size of land ownership caused a decline in poverty in the rural areas in 2005. This is particularly because land is still considered an important factor of production as well as a significant source of income and employment in the rural areas. In 2005, 25.2 percent of landless households lived below the lower poverty line at the national level; this figure for landless rural and urban households was 49.3 and 17.8 percent respectively. However, this magnitude was much higher when considering the upper poverty line. In this situation, poverty at landless national, rural and urban household levels were 46.3, 66.6, and 40.1 percent respectively. On the contrary, less than 4 percent of the households with ownership of 7.5 acres or more land was in poverty, whether considering the lower or the upper poverty line.

Table 2.23: Incidence of poverty by land ownership (size in acres): 2005

	National	Rural	Urban
Lower Poverty Line			
Landless	25.2	49.3	17.8
Less than 0.05	39.2	47.8	23.7
0.05-0.49	28.2	33.3	11.4
0.50-1.49	20.8	22.8	9.1
1.50-2.49	11.2	12.8	2.7
2.50-7.49	7.0	7.7	3.0
7.50 and above	1.7	2.0	0.0
Upper Poverty Line			
Landless	46.3	66.6	40.1
Less than 0.05	56.4	65.7	39.7
0.05-0.49	44.9	50.7	25.7
0.50-1.49	34.3	37.1	17.4
1.50-2.49	22.9	25.6	8.8
2.50-7.49	15.4	17.4	4.2
7.50 and above	3.1	3.6	0.0

Source: Compiled from Table 24, Key Findings (BBS, 2007b: x)

Similarly, access to education and the state of literacy can affect poverty remarkably. Although, it is hard to establish a relationship between literacy and poverty, Table 2.24 shows a negative relationship between literacy and poverty. In 2005, amongst the literate household heads at the national level, 12.3 percent lived in poverty considering the lower poverty line and this figure with the upper poverty line was much higher – 23 percent. In the same year, 36.3 and 54.7 percent of illiterate household heads lived in poverty under the lower and upper poverty line respectively. The poverty situation for both rural and urban illiterate household heads was very similar. Conversely, there was a sharp difference between rural and urban poverty amongst the literate household heads. The large disparity in poverty between the rural and urban literate populations was due to higher employment opportunities in the urban areas. Almost all offices of governmental and non-governmental organisations that employ the literate population are located in the urban areas, thereby employing more urban literate population and resulting in lower poverty in the urban areas.

Table 2.24: Incidence of poverty and literacy of head of household: 2005

	National	Rural	Urban
Lower poverty line			
Literate	12.3	15.3	6.7
Illiterate	36.3	37.5	29.9
Upper poverty line			
Literate	23.0	27.0	15.7
Illiterate	54.7	55.1	52.3

Source: Compiled from Table 23, Key Findings, BBS (2007b: x)

The incidence and concentration of poverty by geographical division is diverse. The incidence of poverty in Barisal, Rajshahi, and Khulna were higher than that of the national level for both rural and urban categories as well as for both lower and upper poverty lines in 2005 as shown in Table 2.25. On the contrary, Chittagong, Dhaka, and Sylhet had lower incidences of poverty than the national level in the same year. This analysis indicates that the incidence of poverty varies across geographical divisions depending on the intensity of economic activities and natural calamities. Both Dhaka and Chittagong divisions have higher employment opportunities than any other division because all eight EPZs are located in Dhaka and Chittagong. These EPZs contain garments and other export-oriented industries that employed a large number of workers during 1990-2010. Sylhet division receives remittances from overseas employment more than any other division because a large number of overseas employees are from this division. Conversely, Barisal, Khulna, and Rajshahi have low opportunity of employment other than agriculture. In addition, agriculture as well as the households of these three divisions is more prone to natural disasters. Both Barisal and Khulna are coastal regions and they are therefore much more affected by cyclones and tidal waves than any other regions. On the other hand, Rajshahi is affected more by droughts and seasonal shortages of foods – locally known as '*Monga'*. These economic and geographical characteristics caused regional variations in poverty amongst the six divisions.

Table 2.25: Incidence of poverty by geographical region/division: 2005

	Lower Poverty Line			Upper Poverty Line		
	National	Rural	Urban	National	Rural	Urban
National	**25.1**	**28.6**	**14.6**	**40.0**	**43.8**	**28.4**
Region/division						
Barisal	35.6	37.2	26.4	52.0	54.1	40.4
Chittagong	16.1	18.7	8.1	34.0	36.0	27.8
Dhaka	19.9	26.1	9.8	32.0	39.0	20.0
Khulna	31.6	32.7	27.8	45.7	46.5	43.2
Rajshahi	34.5	35.6	27.8	51.2	52.3	45.2
Sylhet	20.8	22.3	11.0	33.8	36.1	18.6

Source: Data compiled from Table 6.2 (BBS, 2007b: 58)

Despite Bangladesh's significant economic growth over 1990-2010, the benefit of economic growth was not distributed evenly during this period. Haque (2007) argued that the distribution of income in Bangladesh worsened with the progress of economic growth, resulting in a bigger income gap between the rich and the poor. Even comparisons of rural income inequality, as shown in Table 2.26, suggest that the income variation in the non-farm sector was greater than that in the farm sector. While income inequality was moderate for all rural workers (a Gini coefficient of 39 percent), there were significant differences in comparing sector-specific income inequality. Inequality amongst farm wage earners was low, with a Gini coefficient of only 26 percent, suggesting a relatively homogenous income distribution. Similarly, amongst self-employed farmers, this figure was 39 percent compared to 45 percent amongst self-employed individuals in non-farm activities.

Table 2.26: Poverty and inequality by employment in rural areas: 2000

Poverty Head Count Rate	Wage Farm	Self-employed Farm	Wage Non-farm	Self-employed Non-farm	All Rural Workers
Poverty rate- Upper Line	73	40	49	42	48
Extreme Poverty rate- Lower line	56	25	32	27	33
Income Inequality (Gini coefficient)	0.26	0.39	0.37	0.45	0.39

Source: Data compiled from (World Bank, 2004b: 21)

Similarly, CPD (2007: 21) argued that the income ratio of the highest and the lowest 5 percent at the national level increased from 30.5 times in 2000 to 35.0 times in 2005. This fact has been reflected in Table 2.27. As the Gini Coefficient shows, inequality in distribution of income increased from 0.45 in 2000 to 0.47 in 2005 at the national level. Similarly, the rural income Gini Coefficient increased significantly from 0.39 to 0.43 over the same period. However, the urban income Gini Coefficient remained unchanged at 0.50 during that period. It is argued that income from the non-farm sector as well as remittances from overseas was a major source of inequality for both groups of households. Similarly, income from land and rent from housing also contributed to the increase in inequality. In fact, their contribution was much higher for urban areas compared to the rural areas. Unlike urban areas, salaried wage in rural areas was another important source of inequality because it added income to agricultural income for few households whereas other households had only agricultural income (CPD 2007: 22). Therefore, salaried wage increases the income gaps between rich and poor households.

Table 2.27: Inequality in Bangladesh measured by Gini Coefficient

Household	2000	2005
National	0.45	0.47
Rural	0.39	0.43
Urban	0.50	0.50

Source: Data compiled from the text of (CPD, 2007: 21)

Reduction of poverty is considered as a great challenge for the economy. Nearly 60 million people still live in deprivation and two-thirds of them live in extreme poverty. Thus, in the near future, accelerating economic growth to 7-8 percent annually as well as a sound macroeconomic policy to alleviate poverty and reduce the income gap between the rich and the poor is regarded as a big challenge for the Bangladesh economy.

2.8 Conclusion

From the above analysis of this chapter, it is evident that Bangladesh is a rural-based agricultural economy. It has a large population but it is a poor country in terms of per capita income. Agriculture plays a vital role in the economy considering its contribution to GDP and employment.

In the 1980s and 1990s, Bangladesh shifted its policy paradigm from inward-looking trade and development strategy to an open-economy regime with a view to increasing economic growth and reducing poverty through integration with the world economy.

Consequently, its openness, as measured by trade to GDP ratio, increased considerably. Similarly, Bangladesh experienced significant economic growth over 1990-2009 but poverty remained at a high level. It liberalised agricultural trade and deregulated input markets. Agricultural trade liberalisation facilitated technological transformation in agriculture. However, fragmentation and subdivision of land and an inefficient land management system posed challenges to modernisation of agriculture. Bangladesh agriculture is characterised by subsistence farming, a traditional cultivation system and small-sized farms. Comprehensive policies and measures for modernisation of agriculture focusing on pro-poor growth policy will significantly influence poverty reduction.

The discussions and analyses on the socio-economic context of Bangladesh in this chapter will be useful for understanding the context of the study country and literature related to the theoretical and empirical contexts of agricultural trade liberalisation, which is reviewed in Chapter 3.

CHAPTER THREE

Understanding the Theoretical and Empirical Context of Agricultural Trade Liberalisation

3.1 Introduction

The objectives and research questions for this study were posed in Chapter 1, followed by discussions and analyses of socio-economic conditions of Bangladesh in Chapter 2. Chapter 3 reviews the relevant literature with a view to developing a conceptual and contextual framework for this study including the theoretical and empirical literature in the field of trade liberalisation, agricultural trade liberalisation and studies of agricultural trade liberalisation in Bangladesh.

This chapter also reviews the status of international negotiations on agricultural trade liberalisation, agricultural trade policies in both developed and developing countries, and the debate on distributional consequences and poverty reduction resulting from agricultural trade liberalisation in developing countries. Some of the major studies related to agricultural trade liberalisation in Bangladesh are also reviewed and analysed.

3.2 Trade Liberalisation and its Aspects

Trade liberalisation refers to reducing trade barriers that have been created over a number of years by countries around the world. These barriers are created to protect domestic production (both manufacturing and agriculture) from competition of foreign producers (Duncan and Quang, 2003: 15; Feenstra and Taylor, 2008: 272; Hoekman and Nicita, (2011 In press): 5; Krueger, 2009: 37; Krugman and Obstfeld, 2006: 223; Panagariya, 2009: 557; Turner *et al.*, 2008: 15). These barriers include a complex and opaque assembly of instruments and regulations including various trade controls (such as tariffs, variable levies, import and export subsidies, quotas and other non-tariff barriers), price support measures, income transfers, production subsidies, investment grants etc. (Eicher *et al.*, 2009: 144, 145; Feenstra and Taylor, 2008: 272; Hoekman and Nicita, (2011 In press): 5; Husted and Melvin, 2007: 148; Krugman and Obstfeld, 2006: 186). Trade liberalisation has gained popularity since David Ricardo's analysis of *comparative advantage* which explains how trade will benefit economies with differences in opportunity costs of production (Amoroso *et al.*, 2011: 1; Rahman, 2008: 1; Whaples, 2006: 1; Zhang, 2008: 25).

However, the effects of trade liberalisation on development have been a subject of debate for centuries (Abbott *et al.*, 2009: 353; Chang *et al.*, 2005: 1; Chang *et al.*, 2009: 1; George, 2010; Gingrich and Garber, 2010: 1; Kirkpatrick and Scrieciu, 2006: 2; Nicita, 2004: 1; Rahman, 2008: 1). Ever since David Ricardo's critique on the *Corn Laws* through to the current debate on globalisation, few topics in economics have been more seriously contested as the importance of trade liberalisation for economic development (Abbott, *et al.*, 2009: 353; Chang, *et al.*, 2005: 1; Chang, *et al.*, 2009: 1; George, 2010; Gingrich and Garber, 2010: 1; Kirkpatrick and Scrieciu, 2006: 2; Nicita, 2004: 1). The arguments in favour of free trade are well known and date back at least to Adam Smith's analysis of market specialisation and the principle of absolute advantage in 1776 (Chang, *et al.*, 2005: 2; Chang, *et al.*, 2009: 1; Rahman, 2008: 1; Zhang, 2008: 24, 25). Classical economists argue that free trade is an engine of growth while protection leads to wasteful use of resources, thereby adversely affecting economic development (Chang, *et al.*, 2005: 2; Chang, *et al.*, 2009: 1; Krugman and Obstfeld, 2006: 218, 219; Rodriguez and Rodrik, 1999: 8; Stiglitz and Charlton, 2007: 32, 33; Stone and Shepherd, 2011: 5; UNIDO, 2010: 1). On the contrary, critics argue that openness has its costs and sometimes it could be detrimental to economic development (Chang, *et al.*, 2005: 2; Chang, *et al.*, 2009: 1; Rodriguez and Rodrik, 1999: 8; Stiglitz and Charlton, 2007: 32, 33; Stone and Shepherd, 2011: 5; UNIDO, 2010: 1).

3.2.1 Arguments for Trade Liberalisation

Smith (1776) argued that nations could accumulate wealth (benefits) from free trade and specialisation based on their *absolute advantage* derived from productivity of labour. Similarly, the Ricardian model of *Comparative Advantage* (Ricardo, 1817) suggests that countries get involved in international trade because of their differences in technology and opportunity costs of producing a particular good or service. Both trading countries can benefit from international trade if each country exports goods in which it has a comparative advantage (Amoroso, *et al.*, 2011: 1; Eicher, *et al.*, 2009: 16; Feenstra and Taylor, 2008: 40; Krugman and Obstfeld, 2009; Zhang, 2008: 25). The Ricardian model suggests that trading countries can experience an increase in real income from trade due to countries' specialisation in production of goods and services in favour of their comparative advantage (Chang, *et al.*, 2005: 2; Chang, *et al.*, 2009: 1; Eicher, *et al.*, 2009: 16; Feenstra and Taylor, 2008: 40; Zhang, 2008: 24). Ricardo (1817) argued that productivity of labour generated differences in comparative advantage amongst the trading nations. Conversely, the Heckscher-Ohlin model (Heckscher, 1919; Ohlin, 1933) argues that international trade is largely driven by differences in countries' resources not by productivity of labour. The model argues that comparative advantage is derived from the interaction between nations' resources (factor endowment or relative abundance of factors of production) and the technology of production that influences the relative intensity with which different factors of production are used in producing different goods and services (Amoroso, *et al.*, 2011: 1; Eicher, *et al.*, 2009: 67, 68; Feenstra and Taylor, 2008: 95; Krugman and Obstfeld, 2009; Zhang, 2008: 46). Trade produces a change in relative factors' prices; in turn, it changes relative earnings of factors leading to changes in income distribution. Thus, the owner of a relatively abundant factor gains because of specialisation of production in its favour and the owner of relatively scarce factor loses because of specialisation taken away from it (Amoroso, *et al.*, 2011: 1; Feenstra and Taylor, 2008: 110, 111; Krugman and Obstfeld, 2009; Meschi and Vivarelli, 2009: 287; Zhang, 2008: 46).

According to advocates of trade liberalisation, the shift towards a more open trading regime confers significant benefits (both static and dynamic gains) to the economy. This assertion is based on the belief that there is a strong positive correlation between trade and development strategies and hence trade liberalisation will influence the long-run growth of an economy (Chang, *et al.*, 2009: 1; McCulloch *et al.*, 2003: 21; Meschi and Vivarelli, 2009: 287; Montalbano, 2011: 1).

The static gains from openness are explained by neo-classical trade theories. This advocacy for free trade was based not only on the Ricardian principle of comparative advantage but also on the argument that free trade would contribute to development through competition and learning (Chang, *et al.*, 2005: 2; García-Vega *et al.*, 2011: 58; McCulloch, *et al.*, 2003: 15, 16; Montalbano, 2011: 1; Zhang, 2008: 175). Trade liberalisation promotes the efficient allocation of resources through comparative advantage, allows the dissemination of knowledge and technological progress, and encourages competition in domestic and international markets (Chang, *et al.*, 2005: 2; McCulloch, *et al.*, 2003: 15, 16; Montalbano, 2011: 1; Stiglitz, 2003: 59; Stone and Shepherd, 2011: 5; Zhang, 2008: 175). This is because of the fact that trade liberalisation is meant to work by getting relative prices 'right', which should lead to reallocation of resources from import substitutions to export sectors (Foster, 2008: 544; Krueger, 2010: 5; McCulloch, *et al.*, 2003: 16; Zhang, 2008: 175).

Similarly, trade liberalisation facilitates the increase in new trading partners thus forcing the least productive firms to exit, but it also generates entry of new firms into the export market. This is partly due to the increased exposure to trade that forces all firms to relinquish a portion of their share of domestic market resulting in revenue and profit loss by the least productive firms who do not export (García-Vega, *et al.*, 2011: 63; McCulloch, *et al.*, 2003: 16, 17; Melitz, 2003: 1717). Thus, both market shares and profits are reallocated towards more efficient firms. Both selection effects – entry and exit – contribute to an aggregate productivity increase if the newer firms are more productive than the average level, resulting in a productivity gain and increase in welfare (García-Vega, *et al.*, 2011: 63; Henry *et al.*, 2009: 246; Krugman and Obstfeld, 2006: 219; McCulloch, *et al.*, 2003: 16; Melitz, 2003: 1717; Montalbano, 2011: 1; Okubo, 2009: 534).

Furthermore, trade liberalisation can help increase international trade, economic growth, and welfare by expanding the size of the market (Chang, *et al.*, 2005: 2; Montalbano, 2011: 1). This may in turn yield efficiency and bring benefits not only by exploration of economies of scale but also by a dynamic and upward shift in production function (Chang, *et al.*, 2005: 2; Krugman and Obstfeld, 2006: 219; Montalbano, 2011: 1; San Vicente Portes, 2009: 945). Thus, previously shattered domestic firms may become more competitive and gain the confidence to enter into global competition (Chang, *et al.*, 2005: 2; Montalbano, 2011: 1; San Vicente Portes, 2009: 945).

Dynamic gains have been the focus of modern trade theories and the subject of much of the debate in the literature, in part because they are either poorly understood or difficult to measure (Helpman and Krugman, 1985: 266; Krugman and Obstfeld, 2006: 209; Rodriguez, 2007: 11; Stone and Shepherd, 2011: 5, 6). The dynamic gains from trade liberalisation are due to increased market access for exports with the inherent scope for economies of scale, which leads to increasing returns and eventually the accumulation of human and physical capital (Chang, *et al.*, 2005: 23; Chang, *et al.*, 2009; McCulloch, *et al.*, 2003: 25; Sugimoto and Nakagawa, 2011: 13). This foreign exposure obtained by the export sector in conjunction with higher returns, inspires entrepreneurship and raises productivity of factors above their pre-liberalised levels, which then drives the process forward (Chang, *et al.*, 2005: 23; Chang, *et al.*, 2009; Krugman and Obstfeld, 2006: 219; McCulloch, *et al.*, 2003: 25; Sugimoto and Nakagawa, 2011: 13).

According to advocates of trade liberalisation, the positive externalities associated with the transmission and diffusion of new ideas or knowledge and adoption of more efficient production techniques and management systems generates dynamic efficiencies, which lowers the incremental capital-output ratio and thereby improves economic performance (Chang, *et al.*, 2005: 23; McCulloch, *et al.*, 2003: 25; Meschi and Vivarelli, 2009: 287; Zhang, 2008: 324, 325).

Classical economists argued that trade liberalisation should reduce the domestic price of importable goods by lowering tariffs. This argument is based on the fact that liberalisation, by definition, reduces the barriers to trade and allows markets to function efficiently, resulting in reduction in the domestic prices of the liberalised products by either making cheaper foreign products available or reducing the rents that might previously have been captured by domestic producers (McCulloch, *et al.*, 2003: 15; San Vicente Portes, 2009: 945). Thus, trade liberalisation indirectly contributes to gains arising from a reduction in rent, corruption, and smuggling (Baunsgaard and Keen, 2010: 563; 564; Foster, 2008: 544; Krueger, 1974: 291).

Moreover, trade liberalisation forces domestic firms to be more competitive and reduces their market power that may be built up in protected markets. This may contribute to a lower price and an increased variety and quality of goods (Foster, 2008: 545; Islam and Habib, 2007: 14; McCulloch, *et al.*, 2003: 15). As a result, the welfare of the economy increases in two ways: the consumers are able to obtain a larger quantity and wider range of imports at cheaper prices, and the export sector also benefits from cheaper inputs, resulting in an increase in export competitiveness which leads to a supply-response such that the producers are encouraged to produce for the export sector (Foster, 2008: 545; Islam and Habib, 2007: 14; McCulloch, *et al.*, 2003: 15). Therefore, trade liberalisation increases the degree of competition faced by domestic producers, allowing a country to improve its efficiency of production in three ways: increasing the efficiency with which existing resources are used; encouraging specialisation and reallocation of resources towards those activities that reflect the country's comparative advantage; and allowing economies of scale through exports to the world market (Chang, *et al.*, 2005: 2; McCulloch, *et al.*, 2003: 15, 16; Montalbano, 2011: 1; Stiglitz, 2003: 59; Stone and Shepherd, 2011: 5; Zhang, 2008: 175). In addition to gains from specialisation towards comparative advantage, trade liberalisation may deliver benefits through four channels: opening foreign markets (market access); expanding the demand for goods and services of domestic firms; enabling domestic firms to serve a larger market; and realising gains from economies of scale (Chang, *et al.*, 2005: 2; Montalbano, 2011: 1; Stiglitz, 2003: 25; Stone and Shepherd, 2011: 5; Zhang, 2008: 175).

The theoretical models, as illustrated in endogenous growth models by Young (1991), Grossman and Helpman (1991), Lee (1993), Eicher (1999), and Eaton and Kortum (2002), explain that there are long-run positive growth effects when the areas of specialisation promoted by trade enjoy increasing return to scale. According to these models, liberalisation can raise growth by facilitating import of capital and intermediate goods not available domestically, resulting in an increase in productivity of domestic manufacturing and agricultural sector, in turn, leading to higher economic growth (Foster, 2008: 545; Henry, *et al.*, 2009: 237; McCulloch, *et al.*, 2003: 25; San Vicente Portes, 2009: 944, 945). Furthermore, liberalisation allows improved access to the new ideas and technologies embodied in foreign products. Such access can, in principle, enhance a country's technological capability and assist in productivity improvement (Foster, 2008: 545; Henry, *et al.*, 2009: 237; McCulloch, *et al.*, 2003: 25). Similarly, exporters in developing countries may acquire more knowledge from their interactions with foreign buyers than with domestic customers, implying that firms engaged in trade are likely to have higher productivity than firms that are involved only with domestic selling (Foster, 2008: 445; Montalbano, 2011: 1).

The proponents of openness argue that trade liberalisation has positive impacts on economic growth, which ultimately helps poverty reduction. They argue that if initial inequality is low and growth does not worsen income distribution, the proportion of the population living in poverty will fall as the average income increases (Achterbosch and Roza, 2007: 45; Kirkpatrick and Scrieciu, 2006: 2; McCulloch, *et al.*, 2003: 21;

Naranpanawa *et al.*, 2011: 328, 329; Susila and Bourgeois, 2008: 72). Moreover, if income grows it will be easier for governments to raise and re-allocate resources for supporting poverty reduction policies and programmes.

From the political economy point of view, economists argue that individual countries are free to liberalise trade as much or as little as they want unilaterally, but governments may be under strong political pressure not to liberalise certain sectors (Acharya, 2011: 60; Eicher, *et al.*, 2009: 208; Lee, 2007: 224; McCulloch, *et al.*, 2003: 16; Pupongsak, 2009: 127; Zahrnt, 2009: 269). Therefore, much trade liberalisation actually occurs within the framework of bilateral and multilateral trade agreements when governments may be able to resist such political pressure by obtaining equivalent 'concessions' of foreign market access for their domestic producers (Acharya, 2011: 60; Krugman and Obstfeld, 2006: 221; Lee, 2007: 224; McCulloch, *et al.*, 2003: 16; Pupongsak, 2009: 127). Thus, the benefits of participation in multi-country negotiations on trade liberalisation may be improved by access to foreign markets as well as by the construction of a strong domestic political support base (Acharya, 2011: 60; Krugman and Obstfeld, 2006: 221, 235; McCulloch, *et al.*, 2003: 16; Pupongsak, 2009: 127).

3.2.2 Arguments against Trade Liberalisation

On the other hand, critics of trade liberalisation argue that very cautious views and steps should be adopted to analyse trade liberalisation. Despite the strong intuitive appeal of the policy of trade liberalisation, a good number of criticisms have been directed towards trade reforms and gains from liberalisation.

The free trade advocacy came under serious challenge in the 1930s, as a run-up to the employment problem that had been faced by the world economies during the *Great Depression* (Ahmed and Sattar, 2004: 2; Edwards, 2009: 573; Grytten, 2008: 369; Nerozzi, 2011: 55; Perri and Quadrini, 2002: 128). The search for theoretical foundations to justify the use of trade protections for promoting development led to the formulation of the 'optimum tariff' arguments. The trade protection ranges from infant industry protection to responding to terms of trade deterioration, and to the need to correct distortions in the domestic economy (Ahmed and Sattar, 2004: 2; Barro, 2004: 509, 510; Chang, *et al.*, 2005: 3; Edwards, 2009: 573, 575; Krugman and Obstfeld, 2006: 223; Neary, 2001: 7837).

Critics argue that if market or institutional imperfections exist, openness can lead to sub-utilisation of human and capital resources, concentration on extractive economic activities, or specialisation away from technologically advanced increasing return sectors (Chang, *et al.*, 2005: 2; Chang, *et al.*, 2009: 1; Krugman and Obstfeld, 2006: 405, 406; Panagariya, 2004b: 1150). Grossman and Helpman (1991), and Matsuyama (1992) provided theoretical models where a technologically backward country specialises in a non-dynamic sector as a result of openness, thus, losing out on the benefits of increasing returns. Underlying these models there is an imperfection in contracts or in financial markets that causes people to observe a myopic notion of comparative advantage (Chang, *et al.*, 2005: 2; Panagariya, 2004b: 1149, 1150; Stiglitz and Charlton, 2007: 25, 89). Sachs and Warner (1999) developed a model where specialisation in the extractive economic activities, the natural-resource sector prevents a country from technological progress that eventually leads to long-run growth. In this case, the underlying imperfection is an institutional weakness that encourages natural-resource depletion for quick gains appropriated by certain influential groups of the economy, leading to serious distortions in income distribution and welfare changes against the weak (poor) groups of the economy (Chang, *et al.*, 2005: 2; Krugman and Obstfeld, 2006: 405; Panagariya, 2004b: 1150; Stiglitz and Charlton, 2007: 37). Rodriguez and Rodrik (1999) reviewed the theoretical arguments as to why openness could be detrimental to developing countries. They argued it in the context of theory of the second best, in which trade liberalisation is the policy lever for such quick gains appropriated by certain influential groups in society whilst market imperfections and institutional weakness are accepted as imminent characteristics of the economy. Krugman and Obstfeld (2009) argued that if there was imperfection in domestic markets, a government intervention that appeared to distort incentives in one market might increase welfare by offsetting the consequences of market failures in other markets.

The arguments for protection have been extensively reviewed in the literature. The critics argue to seek an increase in real income through trade protections. These include infant industry arguments, the optimum tariff arguments and arguments related to externalities or correction of domestic market distortions (Ahmed and Sattar, 2004: 3; Chang, *et al.*, 2005: 3; Edwards, 2009: 575; Krugman and Obstfeld, 2006: 223). This argument follows the standard theory of welfare economics and the general theory of the second best that a distortion in trade markets can only be corrected through trade intervention; distortions in the domestic economy need domestic instruments such as taxes and subsidies (Ahmed and Sattar, 2004: 2, 3; Chang, *et al.*, 2005: 3; Edwards, 2009: 575; Greenwald and Stiglitz, 1986: 230; Krugman and Obstfeld, 2006: 225).

However, advocates of free trade such as Friedman (1953), Johnson (1957), Bhagwati (2004, 2008), and Krueger (2009, 2010), criticised the advocacy for trade protection on the grounds that protectionism was based on a weak theoretical framework. They argued that the proposition for protection was based on optimum tariffs arguments, which could lead to distortions in the domestic market. Therefore, protection cannot be treated as a measure of increasing welfare, because correction of a *priori* distortion may not lead to welfare improvement as it introduces another distortion. They argued that protection would not increase welfare; rather free trade could achieve Pareto efficiency – maximisation of welfare for all groups of an economy.

Conversely, some economists such as Greenwald and Stiglitz (1986), Rodriguez and Rodrik (1999), Stiglitz (2003), Rodriguez (2007), Stiglitz and Charlton (2007), and Krugman and Obstfeld (2009) cast doubt on Pareto outcome from free trade. They argued that a country might not, in practice, be able to design and implement the concerted welfare maximising transfers as explained in Pareto optimality because of the existence of externalities, imperfect competition, and asymmetric or imperfect information in the markets.

Given the remarkably weak theoretical underpinnings for protection, as argued by advocates of free trade, one might wonder why the subject of trade protection gained such political support, particularly in developing countries. One of the main reasons for this is the impact of trade liberalisation on income distribution – because some will gain and others will experience loss. Resistance comes from those who might lose income and employment as a result of trade liberalisation. Thus, labour and capital owners in protected industries might jointly resist trade liberalisation (Ahmed and Sattar, 2004: 3; Crisp *et al.*, 2010: 221; Duncan and Quang, 2003: 3; Panagariya, 2009: 556; Zahrnt, 2009: 270).

Critics of free trade criticise neo-classical trade models because they downplay externalities and market imperfection, rather they are based on the assumption of perfect competition (Eicher, *et al.*, 2009: 107, 108; Feenstra and Taylor, 2008: 187, 188; Greenwald and Stiglitz, 1986: 230; Krugman and Obstfeld, 2006: 122, 123).

According to these models, price will always tend towards the point of intersection or equilibrium between the Marshallian downward-sloping demand curve and upward-sloping supply curve. As excess demand below the equilibrium drives the price increase and excess supply above the equilibrium pushes the price decrease, the *'invisible hand'* argued by Adam Smith (Smith, 1776) is presumed to guide and stabilise the economy through elimination of excess demand or supply, thereby increasing welfare of both groups – producers and consumers (Eicher, *et al.*, 2009: 107, 108; Gabre-Madhin *et al.*, 2002: 6; Greenwald and Stiglitz, 1986: 230). However, the critics argue that perfect competition may not exist in reality because of market failure resulting from externalities, monopolies, technological differences, economies of scale and domestic distortion policies (Eicher, *et al.*, 2009: 107, 108; Feenstra and Taylor, 2008: 187, 188; Greenwald and Stiglitz, 1986: 230; Krugman and Obstfeld, 2006: 122, 123). Therefore, free trade may not achieve Pareto efficiency, thereby having welfare consequences – some groups in the economy will experience gain, and other groups will experience loss from trade liberalisation. In this situation, government interventions (e.g. taxes and subsidies) could achieve constrained Pareto efficiency (theory of the second best) that can make everyone better off through income transfer from gainers to losers resulting from trade liberalisation (Blaug, 2007: 185; Bliss, 1987: 27; Greenwald and Stiglitz, 1986: 230; Krugman and Obstfeld, 2006: 225; Stiglitz and Charlton, 2007: 29; Tribe *et al.*, 2010: 186).

The effects of trade on income distribution and poverty reduction have been a subject of intense discussion in the literature. The most well known analytical frameworks are based on the work of Wolfgang Stolper and Paul Samuelson, also known as the Stolper-Samuelson Theorem (Stolper and Samuelson, 1941). Working in the context of the Hecksher-Ohlin model with two factor inputs (labour and capital) and two goods, the theorem demonstrates that a move from a situation of no trade to free trade will reduce the return of relatively scarce factors because of specialisation in favour of abundant factors (Ahmed and Sattar, 2004: 4; Eicher, *et al.*, 2009: 82, 83; Falvey *et al.*, 2010: 230; Stolper and Samuelson, 1941: 59). Tariffs, for example raise the price of the good employing abundant factor intensively, and will tend to benefit the relatively scarce factor. In most cases in developing countries, labour appears to be relatively the abundant factor and capital is relatively the scarce factor. So under the framework of the Heckscher-Ohlin model of trade in developing countries, tariff would likely benefit capital at the expense of labour, arguing that protection is pursued at the cost of abundance factor, which is the reflection of the complexity of government trade policies (Ahmed and Sattar, 2004: 4; Falvey, *et al.*, 2010: 230; Stiglitz, 2003: 59, 60).

Ahmed and Sattar (2004) argued that theories explained quite well why the owners of capital in Bangladesh (owners of large-scale enterprises) were strongly opposed to liberalised trade. Paradoxically, even labour unions were opposed as well. This might be because liberalisation, by pushing competition, would hurt workers in the protected public and private enterprises that would be unable to adjust to increased competition in a lower tariff regime. These workers would also tend to be more organised and militant (Ahmed and Sattar, 2004: 4; Duncan and Quang, 2003: 3; Sugimoto and Nakagawa, 2011: 13). Thus, it is important to recognise the complexities in the real world which is, more often than not, a departure from the simple two-factor two-commodity of Heckscher-Ohlin model (Ahmed and Sattar, 2004: 4; Meschi and Vivarelli, 2009: 287; Shanmugam and Bhaduri, 2002: 601; Sugimoto and Nakagawa, 2011: 13).

'Leontief's Paradox' shook the foundation of neo-classical theories of trade liberalisation. In 1954, Leontief attempted to test the Heckscher-Ohlin theory and found that, in contradiction with Heckscher-Ohlin theory, the USA (one of the most capital-abundant countries in the world) exported labour-intensive commodities and imported capital intensive commodities (Eicher, *et al.*, 2009: 94; Feenstra and Taylor, 2008: 109; Husted and Melvin, 2007: 126; Krugman and Obstfeld, 2006: 3, 74). Some explanations for this paradox dismiss the importance of the comparative advantage as a determinant of trade. For instance, the *Linder Hypothesis* (Linder, 1961) states that demand plays a more important role than comparative advantage as a determinant of trade. According to this hypothesis, countries that share similar demands would be more likely to trade than countries with non-similar pattern of demands (Domit and Shakir, 2010: 188; Fialová, 2010: 4, 9; Hallak, 2010: 453; Husted and Melvin, 2007: 135, 136; Linder, 1961: 94). Similarly, modern trade theories argue that technology varies across countries and the pattern of international trade might be determined much more by these differing technological capacities than by factor endowments (Eicher, *et al.*, 2009: 113; Feenstra and Taylor, 2008: 28; Krugman, 1981: 959; Krugman and Obstfeld, 2006: 77).

Trade liberalisation has been under serious criticism because of unrealistic assumptions, such as perfect competition and constant return to scale, associated with neo-classical Heckscher-Ohlin model of comparative advantage. These restrictive assumptions have been strongly challenged in the light of contemporary practices, suggesting that classical trade theories leave a significant part of international trade unexplained (Acharya, 2011: 60; Krugman, 1981: 959; Krugman and Obstfeld, 2006: 45; Montalbano, 2011: 1). This situation generated *'New Trade Theories'* which recognise the existence of imperfect competition, market power, economies of scale or increasing return to scale and technological differences between trading nations (Acharya, 2011: 60; Baldwin and Forslid, 2006: 143, 144; Bliss, 1987: 21; Eicher, *et al.*, 2009: 118; Feenstra and Taylor, 2008: 189; Krugman and Obstfeld, 2006: 21, 22; Melitz and Ottaviano, 2008: 296; Zhang, 2008: 77, 323).

Advocates of *New Trade Theories* such as Krugman (1979, 1980, 1981, 1991), Lancaster (1980), Dixit and Norman (1980), and Helpman (1981, 1987) argued that trade liberalisation could reduce the wages of unskilled labour even in a labour-abundant country as seen in the case of Mexico, thereby widening the income gap between the rich and the poor across economies as well as within an economy. This argument is because of the fact that most developing countries are endowed with abundance of unskilled labour (Acharya, 2011: 60; Chiquiar, 2008: 70, 92; Falvey, *et al.*, 2010: 230; Hoque and Yusop, 2010; Keleman, 2010: 13). Moreover, even if global economic integration induces faster economic growth through technological innovation in the long run, the substantial reduction in poverty and the adjustment will be costly, with the burden falling disproportionately on the poor – because the poor may not afford investments associated with the adoption of available technology, nor do they have institutional supports to adopt technology to increase production (Acharya, 2011: 60; Banerjee and Newman, 2004: 2; Keleman, 2010: 13; Rakotoarisoa, 2011: 147).

Consistent with those theories, Melitz (2003), and Melitz and Ottaviano (2005) developed a monopolistic competition model of trade with heterogeneous firms (in terms of productivity difference) and endogenous differences in the toughness of competition across countries – in terms of the number and average productivity of competing firms. They found that larger markets exhibit tougher competition, resulting in a lower average mark-up and higher aggregate productivity. Similarly, Baldwin and Forslid (2006) examined the impact of trade liberalisation with heterogeneous firms using the Melitz (2003) model and found that the normative effects of trade liberalisation on aggregate gains from trade and income distribution were Stolper-

Samuelson-like effects: owners of relatively abundant factors gained because of specialisation in favour of their factors but owners of relatively scarce factors experienced loss because of specialisation taken away from their factors, thereby adversely affecting income distribution.

More importantly, based on the Say's Law (Say, 1821): '*supply creates its own demand*', the theoretical underpinnings of neo-classical trade liberalisation models are largely supply-oriented by nature. Critics argue that these neo-classical trade models, based on perfect competition and other naive assumptions, downplay the dynamic demand-side and institutional considerations and instead assume that mere conformity of free trade based on comparative advantage would ensure the acceleration of a country's development. That means simply getting prices right, or neutral, would ensure the best allocation of resources. This concept is based on the Heckscher-Ohlin-Samuelson theorem, which argues that international trade will tend to equalise the absolute and relative income of homogeneous factors across economies (Eicher, *et al.*, 2009: 84; Feenstra and Taylor, 2008: 115; Krugman and Obstfeld, 2006: 77; Taylor and Roda, 2007: 129; Zhang, 2008: 37). This has brought fundamental criticism against the supply-side neo-classical trade models with glaring contrary evidence of the prediction of convergence in per capita and factor incomes across economies due to trade. In fact the so-called catch up claims are largely unobserved in reality because of wide differences in resources, barriers to trade, and international differences in technology (Eicher, *et al.*, 2009: 86; Feenstra and Taylor, 2008: 118; Krugman and Obstfeld, 2006: 77; San Vicente Portes, 2009: 963; Taylor and Roda, 2007: 129).

3.2.3 Empirical Evidence on Impacts of Trade Liberalisation

The theoretical ambiguity on the effects of trade liberalisation is reflected in the available empirical literature. Some studies pointed to strongly positive growth effects from trade liberalisation. This was the case of Sachs and Warner (1999) as well as Edwards (1998), who ran cross-country growth regressions on composite indices of the stance of trade policy and found significant impacts of various individual indicators of trade liberalisation on economic growth. Similarly, Ianchovichina *et al.* (2001), Epifani (2003), Acharya *et al.* (2008), and Acharya (2011) found significant positive impact of trade liberalisation on economic growth.

But others, most notably Harrison (1996), Rodriguez and Rodrik (1999), and Panagariya (2004b) cast doubt on the significance and robustness of the growth benefits of openness. Their critique started with the openness measures used in practice; for instance, some purported openness indicators reflected general poor economic management or were primarily affected by geographic characteristics (e.g. trade volume).

Dollar and Kraay (2004); and Loayza *et al.* (2005) ran growth regressions on panel data of large samples of countries. Both studies used indicators for openness based on trade volumes, control for their joint endogeneity and correlation with country-specific factors, and concluded that opening the economy to international trade brought about significant growth improvements. Using event-study methodology – where an event is defined as a year of substantial trade policy liberalisation – Wacziarg and Welch (2003) found that trade-liberalising countries tend to experience significantly higher volumes of trade, investment rates and, most importantly, growth rates. However, in an examination of 13 country-case studies, they found noticeable heterogeneity in the growth response to trade liberalisation.

Although a small sample did not allow for a definite conclusion, Chang, *et al.* (2009) argued that the growth response after liberalisation was positively related to the economic conditions and political stability of a country. Similarly, Bandinger (2008) argued that differences in institutional quality and trade, due to variation in geography and trade policy, had significant variation in the impact of trade liberalisation on productivity across countries.

Chang, *et al.*(2005; 2009) carried out rigorous regression analyses using data from 82 countries in order to examine how growth-effect of trade liberalisation might depend on a variety of country-characteristics such as educational investment, financial depth, macroeconomic price stability, public infrastructure, governance, labour market flexibility, and ease of a firm’s entry or exit. They concluded that removal of barriers to trade would need to be accompanied by complementary reforms in non-trade areas for improving productivity and growth. Moreover, the impacts of trade liberalisation might depend on the existence and degree of distortions in non-trade institutions as well as on the feasibility of removing those distortions. In addition, reforms of non-trade areas (second generation), along with trade liberalisation had both direct and indirect benefits, in that they allowed a country to take fuller advantage of trade opening. This is a significant argument in the ongoing debate about the gains from more comprehensive trade reforms in developing countries.

Similarly, Foster (2008) conducted regression analyses taking data from 75 countries and found that the impact of trade liberalisation on growth was heterogeneous across countries. While many countries benefited from liberalisation, other countries lost out from liberalising their trading regime. This study suggested that countries with the lowest output growth, and particularly negative rates of output growth, benefited most from trade liberalisation. While countries with the lowest rates of per capita output growth were more likely to benefit most from liberalisation in the long run, they suffered significantly from short-run negative effects of trade liberalisation. He argued that this was partly because the private sector was doubtful about the reform process and did not respond to this reform in the short-run.

Wacziarg and Welch (2008), using the Sachs and Warner (1999) approach, used data from 24 countries over the period 1950-98. Their analyses found that half of the 24 countries exhibited almost zero or negative average economic growth due to trade liberalisation over this period. These countries were Jordan, Guinea-Bissau, Hungary, Mexico, Botswana, Israel, Philippines, Tunisia, Colombia, Cyprus, Paraguay and Poland. Some countries such as Mali, Benin, Guyana, Guinea and Ghana experienced a moderate growth rate ranging from an average of 1.19 to 1.99 percent. However, seven countries experienced considerable economic growth due to trade liberalisation ranging from 2.24 to 3.62 percent. They argued that countries which experienced negative or no effects of trade liberalisation on economic growth tended to have suffered from political instability, adopted contractionary macroeconomic policies in the aftermath of reforms, or undertaken efforts to counteract trade reforms by shielding sectors from necessary adjustment.

Montalbano (2011) argued that trade liberalisation could have negative impacts on household welfare through generating instability in domestic markets originating from foreign shocks through main transmission channels of trade liberalisation. Furthermore, when foreign shocks are greater than domestic price stabilisation capability, trade liberalisation may also affect governments' ability to operate price stabilisation policies. He concluded that trade theories could not provide a full understanding of the links between trade liberalisation, shocks, and uncertainty. He further argued that empirical evidence remained mixed, scattered in separate fields of analysis and did not reach a common stance. Therefore, whether trade liberalisation affected (and to what extent) the long-term welfare of some countries or households by raising their uncertainty about the future and/or their “risk exposure” to external shocks was still uncertain (Montalbano, 2011: 8; Sugimoto and Nakagawa, 2011: 12).

Naranpanawa, Bandara and Selvanathan (2011) found that, in the long run, impacts of trade liberalisation on the welfare of households in the manufacturing sector were pro-poor but the agricultural sector created uneven benefits across different household groups in Sri Lanka. They argued that household endowments in the manufacturing sector were relatively even (mostly labour) while household endowments in the agricultural sector were relatively heterogeneous and uneven (land, labour and non-farm income). They argued that further trade reforms might widen the income gap between the rich and the poor thus increasing relative poverty. Like Chang *et al.* (2005; 2009), they also indicated that implementing complementary policies (such as income transfers from the rich to the poor) would ease out the adjustment costs of trade liberalisation for low-income groups in the short run and investing physical infrastructure and human capital in the long run.

Narayanan, Hertel and Horridge (2010) used computable general equilibrium (CGE) estimation tools to estimate both partial equilibrium (PE) and general equilibrium (GE) models separately and the PE-GE model jointly. They found that the PE-GE model showed higher welfare gain from trade liberalisation than either of the PE or GE models, indicating that empirical results were influenced by model specifications.

Acharya (2011) found conflicting results in two simulations regarding the effects of trade liberalisation on the welfare of Nepalese households. In the first simulation using CGE models, he found that the rich gained more than the poor from trade liberalisation, indicating that the growth was not pro-poor. Conversely, in the second simulation, after restructuring the model he found that the poor gained largely from trade liberalisation, suggesting that the growth was pro-poor. This study reinforced that empirical findings are based on model specifications and measurement variables.

Therefore, the effects of trade liberalisation on development have been a subject of ongoing debate. The evidence remains mixed and loaded with criticisms on the grounds of choice of liberalisation determinants, model specifications and methodology as well as other measurement shortcomings.

3.3 Agricultural Trade Liberalisation and Growth

Historically, the agricultural sector has been highly protected in both developed and developing countries due to its multifunctionality (Anderson, 2004: 22; Daniel and Perraud, 2009: 5132; Huylenbroeck *et al.*, 2007: 5, 7, 8; Lecardane and Giampaolo, 2009: 1; Morgan *et al.*, 2010: 116, 125; Murphy, 2003: 2; Rahman, 2008: 11; Thirtle *et al.*, 2001: 3; World Bank, 2008b: 25). Multifunctionality of agriculture relates to its multiple roles in the economy such as food production, food security, income and employment generation, poverty reduction, development of non-farm sectors through multiplier effects, macroeconomic stability (through maintaining stable food prices), and environmental protection (Anderson, 2004: 22; Daniel and Perraud, 2009: 5132; Economic and Social Research Foundation, 2010: 21; Huylenbroeck, *et al.*, 2007: 5, 7, 8; Lecardane and Giampaolo, 2009: 1; Morgan, *et al.*, 2010: 116, 125; Murphy, 2003: 2; Thirtle, *et al.*, 2001: 3; World Bank, 2008b: 25).

However, since the 1980s the re-emergence of the neo-classical orthodoxy as the new development paradigm, many developing countries adopted agricultural trade liberalisation and market reform programmes (Gingrich and Garber, 2010: 2; Meijerink and Roza, 2007: 6; Meschi and Vivarelli, 2009: 287; Rahman, 2008: 11; Salim and Hossain, 2006: 2567). These programmes were undertaken with a view to reducing government control over both agricultural input and output markets, lowering tariff and non-tariff barriers and allowing market forces to work in agriculture (Gingrich and Garber, 2010: 2; Meschi and Vivarelli, 2009: 287; Salim and Hossain, 2006: 2567). This view is based on the arguments and belief that agricultural trade liberalisation contributes to growth through facilitating technological innovation and re-allocation of productive resources (Chang, *et al.*, 2005: 2; McCulloch, *et al.*, 2003: 15, 16; Montalbano, 2011: 1; Stiglitz, 2003: 59; Stone and Shepherd, 2011: 5; Zhang, 2008: 175). Therefore, many developing countries adopted liberalisation policies as a means to improve productivity in agriculture with the aim of reducing poverty (Gingrich and Garber, 2010: 2; Meschi and Vivarelli, 2009: 287; Salim and Hossain, 2006: 2567).

There are arguments that agricultural trade liberalisation contributes to technological transformation and improves productivity of agricultural inputs allowing competition and efficient factor-allocation, leading to higher economic growth (Henry, *et al.*, 2009: 237; McCulloch, *et al.*, 2003: 25; San Vicente Portes, 2009: 944, 945; Stiglitz, 2003: 59; Stone and Shepherd, 2011: 5). It facilitates technological transformation in the agricultural sector with improved access to imported inputs, machinery and knowledge leading to an increase in productivity (Foster, 2008: 545; Henry, *et al.*, 2009: 237; Lipton, 2006: 60; McCulloch, *et al.*, 2003: 25; Meijerink and Roza, 2007: 10). These arguments further suggest that the agricultural input market becomes more competitive through diffusion of modern production technology and knowledge in agriculture as a result of agricultural trade policy reforms. Improved technology contributes to agricultural growth and welfare of the rural economy (Foster, 2008: 545; Henry, *et al.*, 2009: 237; Lipton, 2006: 60; McCulloch, *et al.*, 2003: 25; Thirtle, *et al.*, 2001: 4). This suggests that technological progress particularly in irrigation, fertiliser, pesticides, and hybrid seeds can enhance significant growth in agriculture and contribute to poverty alleviation.

Agricultural growth in developing countries has received considerable attention as a vehicle for poverty reduction. The dominant paradigm shift of structural transformation since the 1980s has seen agriculture as an 'engine of growth' in countries that are in the early stages of development. This is particularly because of agriculture's high share of economic activity and strong growth linkages with the rest of the economy (Byerlee *et al.*, 2005: 1; Mosley and Chiripanhura, 2009: 750; Novielli, 2010: 1; Thirtle, *et al.*, 2001: 11; World Bank, 2008b: 44). In this paradigm, agricultural growth is perceived as the prime factor to enhance the welfare of rural households in developing countries, because the sector is dominated by small-scale rural farm households (Byerlee, *et al.*, 2005: 1; Popli, 2010: 803; Thirtle, *et al.*, 2001: 11; Valenzuela *et al.*, 2005: 1). Furthermore, agricultural productivity growth has extensive multiplier effects on both farm and non-farm sectors (Byerlee, *et al.*, 2005: 1; Popli, 2010: 803; Thirtle, *et al.*, 2001: 11; Valenzuela, *et al.*, 2005: 1).

The poverty reduction and welfare enhancement effects of the agriculture-driven growth paradigm is predicated on arguments that the adoption of technological innovations in agriculture has a direct impact on increased productivity and an indirect impact on the price of food for net buyers and labour effects by generating employment in both the farm and non-farm sectors and income through higher wages (Byerlee, *et al.*, 2005: 1; Meijerink and Roza, 2007: 14; Mosley and Chiripanhura, 2009: 751; Popli, 2010: 803; Thirtle, *et al.*, 2001: 11; Valenzuela, *et al.*, 2005: 1). These growth linkage effects might be powerful when agricultural growth is driven by broad-based productivity increases in a rural economy dominated by small and medium-sized farm households. Because of these strong growth linkage effects, agricultural growth can lead to wider economic growth through technological innovation (Adeoti and Sinh, 2009: 6; Byerlee, *et al.*, 2005: 4; Meijerink and Roza, 2007: 10; Popli, 2010: 803; Thirtle, *et al.*, 2001: 8, 9; Williams and Smith, 2008: 8).

Agriculture has strong and direct forward linkages to agriculture processing and backward linkages to input-supply industries. These linkages drive growth in the rural non-farm sector (Byerlee, *et al.*, 2005: 3; Islam and Habib, 2007: 4; Meijerink and Roza, 2007: 14; Thirtle, *et al.*, 2001: 10). This strong growth-linkage effect of agricultural trade liberalisation through technological transformation is the strategy referred to as agricultural-demand-led-industrialisation. This strategy emphasises the role of agricultural productivity growth in achieving industrialisation through expanding demand for goods produced by domestic industry (Byerlee, *et al.*, 2005: 4; Islam and Habib, 2007: 4; Meijerink and Roza, 2007: 15; Thirtle, *et al.*, 2001: 10, 14; Williams and Smith, 2008: 8).

The achievement of significant growth in agriculture induced by technological innovation was demonstrated in many Asian countries through the green revolution since the 1960s that spread rapidly as a demonstration effect throughout the region in the 1970s and 1980s, especially in densely populated regions (Adeoti and Sinh, 2009: 7; Barichello, 2004: 2, 6; Byerlee, *et al.*, 2005: 1; Meijerink and Roza, 2007: 2). It is argued that the success of East Asian countries such as Japan, South Korea and China in agriculture was generated by technological breakthrough in the form of high-yielding varieties of rice in association with farmers' access to fertilisers and irrigation, which provided a significant improvement in agricultural productivity growth (Adeoti and Sinh, 2009: 6, 7; Byerlee, *et al.*, 2005: 9; IFAD, 2002: 63). The East Asian success was a source of inspiration for many developing countries, including Bangladesh, to liberalise input sectors. This initiative was based on the objective to improve productivity of agricultural inputs through technological innovation with a view that higher productivity growth would help to alleviate poverty by a greater scale.

Agricultural trade liberalisation contributes to economic growth through increasing food production and macroeconomic stability. Although both developed and developing countries pursue agricultural policies cautiously to maintain food security in the domestic economy, from a theoretical point of view it is argued that agriculture-led development is based largely on the experience of Asian countries and does not explicitly recognise the potential for trade in food products. This argument is based on the assumption that food is a non-traded product in many developing countries (Byerlee, *et al.*, 2005: 8; Pyakuryal *et al.*, 2010: 21). However, most countries consider agriculture an important sector in domestic food production and thereby pursue food self-sufficiency policies, in large part to avoid macroeconomic and political instability from food price shocks (Anderson and Nelgen, 2010: 3; Byerlee, *et al.*, 2005: 8; Pyakuryal, *et al.*, 2010: 21).

3.4 Agricultural Trade Liberalisation, Distributional Consequences and Poverty Reduction

Agricultural trade liberalisation has generated substantial debate regarding the gains and losses from trade liberalisation. The comparative advantage of developing countries is associated with the agricultural sector. Therefore, the protectionist policies in developed countries are criticised for preventing developing countries benefiting from world trade (Anderson *et al.*, 2011; Berrittella *et al.*, 2008: 632; Bureau *et al.*, 2005: 1; Tokarick, 2008: 199). Many studies such as Hertel *et al.* (2007), Rakotoarisoa (2011), and Acharya (2011) suggest that developing countries will derive the most benefit from agricultural trade liberalisation, if an ambitious agreement brought about free trade. On the contrary, some studies such as Bureau *et al.* (2005), Wailes (2004), Wise (2008) and Tokarick (2008) argued that the positive effects on developing economies from elimination of subsidies in developed countries' agriculture might be overestimated. They studied samples from a number of countries and found that the consequences of agricultural trade liberalisation for developing countries were complex. For example, middle-income developing countries confronted with high protection in their main markets benefited from liberalisation because of substantial growth in prospects and prices for a relatively high-performing export sector. However, for net food importing countries including most of the LDCs and the small island developing states and cotton importing countries such as Bangladesh, agricultural trade liberalisation might have negative consequences because of terms of trade effects, non-tariff issues, and supply side constraints being likely to limit possible expansion of their exports.

Agricultural trade liberalisation contributes to growth through technological transformation and productivity improvement. However, the distributional impact of this growth can be mixed despite the extensive spread of technological transformation in agriculture. Even where agriculture retains comparative advantage, the liberalisation of trade raises questions about the pro-poor effects of agricultural productivity improvement due to issues related to income distribution (Acharya, 2011: 61; Acharya and Cohen, 2008: 1057; Gabre-Madhin, *et al.*, 2002: 1; Gerard and Piketty, 2007: 2; Keleman, 2010: 13; Rakotoarisoa, 2011: 147). Therefore, the effect of agricultural trade liberalisation on welfare is highly contested in the development economics literature (Cassel and Patel, 2003: 6; Keleman, 2010: 13; Rakotoarisoa, 2011: 147; Sexton *et al.*, 2007: 253).

Advocates of trade liberalisation argue that agricultural trade liberalisation will expand the small domestic market, provide access to foreign direct investment, create greater competition, facilitate technology transfer, generate marketing networks, and provide much-needed technical and managerial skills, resulting in higher economic growth (Annabi *et al.*, 2006: 4; Henry, *et al.*, 2009: 237; McCulloch, *et al.*, 2003: 15, 16; Stone and Shepherd, 2011: 5; Zhang, 2008: 175). They argue that agricultural trade liberalisation contributes to higher economic growth and thereby reduces poverty.

However, there has been a substantial debate on welfare gains and losses from economic growth resulting from technological transformation as a consequence of agricultural trade liberalisation. This debate is much more about distributional consequences and welfare implications than net gains and net losses (DFID, 2004: 10; Mendola, 2007: 373; Orden, 2006: 378; Pyakuryal, *et al.*, 2010: 20, 31; San Vicente Portes, 2009: 945). The first fundamental theorem of welfare economics argues that subject to certain exceptions – such as externalities, public goods, economies of scale and imperfect competition – every competitive-equilibrium is Pareto-optimal. Similarly, the second fundamental theorem states that every Pareto-optimal allocation of resources can be realised as the outcome of competitive equilibrium after a lump-sum transfer of claims on income (Blaug, 2007: 185; Bliss, 1987: 27; Greenwald and Stiglitz, 1986: 230; Krugman and Obstfeld, 2006: 225; Stiglitz and Charlton, 2007: 28, 29; Tribe, *et al.*, 2010: 186). In fact, Pareto-optimality may not be achieved in the farm sector in the sense that agricultural trade liberalisation may affect some groups of rural households adversely despite the gains from this process by other groups. Moreover, perfect competition may not exist in the agriculture of developing countries due to market failure in the form of some externalities. Nevertheless, it is argued that agricultural trade liberalisation expands the non-farm sector in the rural economy as a multiplier effect. The wage in the non-farm sector is usually higher than that of agriculture due to higher productivity of labour (Popli, 2010: 803; Tribe, *et al.*, 2010: 186; World Bank, 2004b: 5). Some wage-labourers may shift their work from agriculture to the non-farm sector with higher wages. This will represent a Pareto improvement in the sense that some labourers are better off and other agricultural labourers are not worse off due to the development of the non-farm sector resulting from agricultural trade liberalisation (Greenwald and Stiglitz, 1986: 229; Todaro and Smith, 2006: 155; Tribe, *et al.*, 2010: 186).

Although many studies indicated that agricultural trade liberalisation had made a significant contribution to economic growth through technological transformation in the agricultural sector, understanding the process of pro-poor economic growth and explaining the vast differences in economic performance across countries have been fundamental challenges for researchers as well as for policy makers (Chiquiar, 2008: 71; Gerard and Piketty, 2007: 2; Henry, *et al.*, 2009: 72; Kong, 2007: 1; Topalova, 2010: 3). One of the main reasons for the lack of empirical consensus on growth determinants relates to model specification, the choice of control variables and measurement shortcomings (Acharya, 2011: 61; Achterbosch and Roza, 2007: 33, 34; Daniel and Perraud, 2009: 133; Durlauf, S. N. *et al.*, 2008: 2; Narayanan, *et al.*, 2010: 755).

The impact of agricultural trade liberalisation on the welfare of rural households depends on not only how income is distributed to them but also what happens to average living standards of the rural livelihoods. Even the same level of productivity growth may result in various levels of poverty reduction in different countries depending on their respective policies and income distribution (Chang, *et al.*, 2009: 2; Duncan and Quang, 2003: 14; Ravallion, 2004: 12; Winters *et al.*, 2004: 107, 108). Ravallion (2004) argued that it should point to implications for policies that would be needed for rapid poverty reduction, in addition to promoting higher growth. He suggested that two sets of factors could be identified as the main proximate causes of the differing rates of poverty reduction at given rates of growth – the initial level of inequality, and how inequality changes over time. The higher the initial inequality in a country, the less is the gain from growth that tends to be shared (Orden, 2006: 379; Ravallion, 2004: 12; San Vicente Portes, 2009: 946; Susila and Bourgeois, 2008: 72, 76).

One of the key issues raised repeatedly in development economics is the mechanism through which an economy can grow fast and at the same time can lead to a more productive use of underutilised resources (Duncan and Quang, 2003: 6; Nissanke and Thorbecke, 2007: 2; Ruda, 2007: 711; Susila and Bourgeois, 2008: 75). This is another way of saying that development economics and good development strategies are about identifying technological transformations that lead to higher economic growth while simultaneously contributing to a decline in the numbers of underemployed and unemployed workers – ultimately accelerating poverty reduction (Duncan and Quang, 2003: 6; Nissanke and Thorbecke, 2007: 2; Ruda, 2007: 711; Susila and Bourgeois, 2008: 75).

Much of the current debate in development economics is focused on fundamental issues such as the impacts of agricultural trade liberalisation on poverty as opposed to the proximate factors such as macroeconomic policy (Durlauf, *et al.*, 2008: 330; Pan and Christiaensen, 2011: 24; Susila and Bourgeois, 2008: 72; Topalova, 2010: 3). The relationship between economic growth and poverty has become an important issue within development policy analysis. There has been serious criticism of existing growth theories because of their weakness in explaining growth-poverty relationships and restrictive assumptions (Duncan and Quang, 2003: 23; Durlauf, *et al.*, 2008: 329; Gore, 2007: 31; Holub *et al.*, 2004: 437; Jones, 2008: 1103). Some economists such as Rodrik (1988), Devarajan and Rodrik (1989), Rodriguez and Rodrik (2001), Gore (2007), Rodriguez (2007), Durlauf, Johnson and Temple (2008), Durlauf, Kourtellos and Tan (2008), and Jones (2008) argued that neoclassical and new endogenous growth theories, based on aggregate production function and general equilibrium framework, were not good for the poor because their conceptual structure did not enable a good explanation of the growth-poverty relationship. In contrast, alternative growth theories that take account of the technological capabilities of economic agents and their institutional matrix, the dynamics of production structures and the role of demand are good for the poor in this sense. This situation has raised the need to provide an alternative theoretical framework for analysis of pro-poor growth. A theory is regarded as a good mechanism for the poor if it provides a good explanation for poverty trends and it thereby enables the design of effective poverty reduction policies (Durlauf, *et al.*, 2008: 330; Gore, 2007: 31; Rodriguez, 2007: 12). Technological progress can provide gains for some people and losses for others. Therefore, the overall impact depends on the economy-wide outcome (Durlauf, *et al.*, 2008: 330; Gore, 2007: 31; Rodriguez, 2007: 12). Thus, linking technological progress to poverty is an important issue in the context of analysing how technological progress affects economic growth and how growth, in turn, affects the growth-poverty relationship.

Agricultural growth may reduce poverty through direct effects on farm productivity, incomes, and employment. It may also generate indirect impacts on the welfare of rural households through the growth linkage with the non-farm sector as well as through its impacts on food prices (Adeoti and Sinh, 2009: 6; Bezemer and Headey, 2008: 1343; Byerlee, *et al.*, 2005: 4; Popli, 2010: 803; Thirtle, *et al.*, 2001: 11; Valenzuela, *et al.*, 2005: 1). There have been arguments that the poor typically spend a high share of their income on staple food; therefore, they benefit from a decline in the price of staple food induced by productivity improvement as a result of agricultural trade liberalisation. Benefits are greater for the urban poor and landless rural labourers since they are net food purchasers (Adeoti and Sinh, 2009: 6; Bezemer and Headey, 2008: 1343; Byerlee, *et al.*, 2005: 5).

Although agricultural trade liberalisation may improve productivity through technological innovation, this growth may not be pro-poor (Meijerink and Roza, 2007: 11; Popli, 2010: 803, 811; Ravallion, 2003: 15; 2009: 28, 29). However, some studies such as Byerlee, Diao and Jackson (2005), Winters, McCulloch and McKay (2004), and Bezemer and Headey (2008) argued that interaction of productivity growth, farm income, employment, and food prices could lead to a pro-poor outcome depending on two key conditions. Firstly, agricultural productivity per unit of labour must increase to raise farm income, but agricultural productivity per unit of land must increase at a faster rate than that of labour in order to raise employment and rural wages. Secondly, increased total factor productivity (TFP) in agriculture must result in a decrease in real food prices, but TFP must increase faster than food prices decrease for farm profitability to rise and for poor consumers to benefit from lower food prices.

Hertel (2006), Popli (2010), and Gingrich and Garber (2010) found that the impacts of agricultural trade liberalisation on poverty and inequality would depend on a number of important factors. First, the extent of price transmission from the border to the local markets could vary widely – even within a given country, as was seen in the case of Mexico. Poor infrastructure and high transaction costs insulate rural consumers from world price rises, while penalising exporters. Thus, households would gain from price increases due to agricultural trade liberalisation if they were net suppliers. However, in the case of the poorest households, their ability to increase production might be constrained by the lack of key productive assets, thereby limiting their supply response. This limited supply response can hinder the potential for such commodity price increases to pull the poor households out of poverty in the absence of complementary policies such as improved access to credit and advanced technology. Consequently, trade liberalisation resulted in adverse effects on poverty and income distribution in Mexico (Hertel, 2006: 11; Nicita, 2009: 26; Nissanke and Thorbecke, 2007: 2, 7; Popli, 2010: 811).

Development of the non-farm sector in rural areas as multiplier effects of agricultural trade liberalisation is important due to its role in poverty reduction through generation of income and employment (Byerlee, *et al.*, 2005: 3; Islam and Habib, 2007: 4; Meijerink and Roza, 2007: 14; Thirtle, *et al.*, 2001: 10; World Bank, 2008b: 28, 29). Ravallion (2004) argued that the intensity of poverty in the Indian states where non-farm growth did not occur was much higher than that of the states with non-farm sector growth.

Based on conventional wisdom, Anderson (2004) argued that higher economic growth would contribute to greater reduction in poverty; and aggregate economic growth differences were largely responsible for the differences in poverty alleviation across regions. He argued that initiatives to boost economic growth were, therefore, likely to be helpful in poverty reduction. Agricultural trade liberalisation is such an initiative that tends to boost economic growth through enhancing productivity of agricultural inputs. However, it may also alter relative product prices, which in turn may affect factor prices (Anderson, 2004: 1; Burstein and Vogel, 2011: 25; Topalova, 2010: 3; Xu, 2003: 417). Hence, the net effect of agricultural trade liberalisation on poverty reduction also depends on the directions of those domestic product price changes and, in turn, how they affect domestic factor prices. It is argued that if the price changes are pro-poor, then they will tend to reinforce any positive-growth effects of agricultural trade reform on the poor. Moreover, the outcome of this reform also depends on complementary pro-poor domestic policies (Anderson, 2004: 2; Meijerink and Roza, 2007: 12; Susila and Bourgeois, 2008: 75).

While trade liberalisation has facilitated agricultural growth through diffusion of modern technology and knowledge, the agro-pessimists argue that the contribution of agriculture to development is passive. Conversely, agro-pragmatists argue that agriculture has a significant role in growth as well as in poverty reduction. However, agricultural trade liberalisation may worsen the conditions of the poor in the form of higher prices due to the price of food in liberalised markets being determined more by world prices than by domestic productivity. This is because many governments of developing countries use control over external trade to hold domestic food prices below world prices (Anderson, *et al.*, 2011: 1, 2; Byerlee, *et al.*, 2005: 8; Huylenbroeck, *et al.*, 2007: 3; Keleman, 2010: 13, 26). Similarly, technological transformation as a result of agricultural trade liberalisation is sometimes seen as a source of impoverishment in the form of loss of employment leading to an increase in poverty because it is associated with a process of creative destruction. In this process, jobs and livelihoods are destroyed in some sectors whilst being created in others. Therefore, there may be some gainers as well as some losers resulting from agricultural trade liberalisation (Banerjee and Newman, 2004: 16; Gore, 2007: 31; OECD, 2011: 12; Susila and Bourgeois, 2008: 74, 75).

3.5 World Scenario of Agricultural Policies and Trade Liberalisation

Since World War II, agricultural policy in developed countries has been driven by three main objectives to: (1) ensure food security by promoting food surpluses; (2) increase agricultural productivity by promoting technological progress; and (3) maintain a fair standard of living for the agricultural community. The upshot of these objectives has generated agricultural trade protections with a complex and opaque assembly of instruments and regulations including various trade controls (such as tariffs, variable levies, quantitative restrictions on imports and export subsidies), price support measures, income transfers, production subsidies and investment grants (Ahmed and Sattar, 2004; Anderson and Nelgen, 2010: 8; Byerlee, *et al.*, 2005; Gingrich and Garber, 2010: 1, 2; McCulloch, *et al.*, 2003: 174; Rakotoarisoa, 2011: 147, 148; Sugimoto and Nakagawa, 2011: 13). On the contrary, although agriculture is still considered to be an important sector in developing countries, contributing nearly 28 percent to GDP, most developing countries pursued policies of import substitutions (in order to protect the manufacturing sector) that were heavily biased against agriculture (Anderson and Nelgen, 2010: 8; Bezemer and Headey, 2008: 1347; Gingrich and Garber, 2010: 1; Hertel, T. *et al.*, 2007: 2; Williams and Smith, 2008: 6). Moreover, agriculture was often subject to direct and indirect taxes as well as being a source of tax, capital and investment surplus, and fiscal revenue. (Anderson and

Nelgen, 2010: 8; Gingrich and Garber, 2010: 1; Hossain and Deb, 2003: 147; McCulloch, *et al.*, 2003: 172, 175; Rakotoarisoa, 2011: 147; Williams and Smith, 2008: 6; World Bank, 2008b: 40, 96). These contradictory agricultural policies in developed and developing countries often create a policy bias against the poor in both domestic and international markets (World Bank, 2008b: 96).

Some economists such as Gawande and Krishna (2003), Kim (2007), and Zahrnt (2009) argued that agricultural trade liberalisation included socio-economic and political costs such as (1) removal of trade barriers could worsen a country's terms of trade; (2) reduction in tariff rates could decrease government's revenue; (3) acceptance of multilateral (WTO) disciplines could limit a country's economic policy options; (4) economic adjustment and restructuring in the post-liberalisation periods could be both economically and politically costly in the form of socio-economic and political unrest; and (5) trade liberalisation could raise unemployment and increase inequality and poverty.

Despite agriculture playing an important role in developing countries, their agricultural policies ignored the importance of agriculture in economic development. This is probably because of the view of development theorists, led by Arthur Lewis in the 1950s, that agriculture is a passive contributor to economic development, and agriculture acts more as a source of food and labour (subsistence sector) than a source of growth (Byerlee, *et al.*, 2005: 2; Figueroa, 2004: 736; Kirkpatrick and Barrientos, 2004: 683, 684; Krueger, 2010: 2; Lewis, 1954; Tignor, 2004: 702; Williams and Smith, 2008: 6). However, this development orthodoxy (reflecting Lewis's view) was seriously challenged by other development theorists such as Johnston and Mellor (1961), Ranis and Fei (1961), Mellor (1976), Meijerink and Roza (2007), and Bezemer and Headey (2008). They argued that agriculture and industrial development were interdependent and agriculture played a dynamic role to stimulate economic growth. Similarly, the World Bank (2008b) argued that agriculture could work in concert with other sectors to produce faster growth, reduce poverty, and sustain the environment.

Contrary to Lewis's view, agricultural growth is still seen as a necessary factor for successful economic transformation for two reasons: (1) to ensure food supply and prevent rising food prices and real wages from undermining industrial development; and (2) to utilise a major natural resource – land – as an additional 'free' source of growth that would not compete with resources for industrial growth (Byerlee, *et al.*, 2005: 3; Huylenbroeck, *et al.*, 2007: 5; Novielli, 2010: 1; Williams and Smith, 2008: 7; World Bank, 2008b: 2, 3). In addition to food supply and the employment of a major work force, agricultural productivity growth, contrary to conventional wisdom, has outpaced that of manufacturing in developing countries; agriculture even dominates exports of some developed countries such as Australia, Denmark, and New Zealand. (Byerlee, *et al.*, 2005: 7; Figueroa, 2004: 746; Gerard and Piketty, 2007: 3; Stringer and Pingali, 2004: 2; Williams and Smith, 2008: 7).

Nonetheless, Lewis's development theory of 'dualism' (with industry as the 'modern' and agriculture as the 'traditional' sector, thereby giving priority to industrialisation over agriculture) (Cristiano, 2007: 11; Figueroa, 2004: 736; Kirkpatrick and Barrientos, 2004: 685; UNIDO, 2010: 11) was applied to support industrialisation-led strategies adopted by many developing countries during the 1950s and 1960s, and even later in the 1970s, resulting in a pronounced 'urban bias' in policy and investment decisions throughout those periods (Anderson, 2004; Byerlee, *et al.*, 2005: 3; Cristiano, 2007: 11; Figueroa, 2004: 736; Meijerink and Roza, 2007: 1). However, beginning in the 1960s, a major revision in development thinking argued for a central role of agriculture as a driver of growth, especially in the early stages of industrialisation (Byerlee, *et al.*, 2005: 3; Meijerink and Roza, 2007: 1; Williams and Smith, 2008: 3; World Bank, 2008b: 44). This view of agriculture having an active role, stimulated in large part by the emerging experience in Asia, was founded on two core contributions. Firstly, it is recognised that traditional agriculture could be transformed rapidly into a modern sector through the adoption of science-based technology, thereby making a large contribution to the overall growth. Secondly, economists identified the strong growth linkage and multiplier effects of agricultural growth to non-agricultural sectors (Adeoti and Sinh, 2009: 10; Anderson, 2004; Bezemer and Headey, 2008: 1346; Byerlee, *et al.*, 2005: 3; Meijerink and Roza, 2007: 2; World Bank, 2008b: 27, 158).

The agricultural sector is politically sensitive in both developed and developing countries. Political lobbies significantly influence agricultural policy; therefore, implementing freer trade in agriculture requires designing incentive schemes that take into account the status-quo political-economic equilibrium (Ahmed, *et al.*, 2007: 23; Altenburg, 2011: 19; Crisp, *et al.*, 2010: 223; Gawande, 2005: 1; World Bank, 2008b: 42, 96; Zahrnt, 2009: 285). In the policy process, various interest groups exert pressures and counter-pressures on the government; and government responses are usually conditioned by the mutuality of interest of the pressure groups and the ruling elites. Even if the reform proposals and measures are sound on economic grounds, they need to have political acceptability for their successful implementation, otherwise interest groups may force the government to backtrack and adopt policies that are less feasible on economic considerations (Ahmed, *et al.*, 2007: 23; Crisp, *et al.*, 2010: 223; Gawande, 2005: 1; World Bank, 2008b: 42, 96; Zahrnt, 2009: 285). Therefore, successive governments formulate and implement agricultural policies balancing a variety of objectives against a range of constraints through absorbing pressures and counter-pressures from various interest groups (Ahmed, *et al.*, 2007: 23; Altenburg, 2011: 19; Crisp, *et al.*, 2010: 223; Gawande, 2005: 1; World Bank, 2008b: 42, 96; Zahrnt, 2009: 285). .

Similarly, accomplishing free trade in agriculture requires effective bargaining at the level of diplomacy. Effective bargaining at that level must be performed over policy options that are politically viable domestically, since governments do not want to step on a political trap; rather they want to serve their constituencies first (Gawande, 2005: 1; World Bank, 2008b: 42; Zahrnt, 2009: 285). Thus, multilateral trade negotiations that seek to implement trade liberalisation in agriculture must recognise the politico-economic factors that lead to continuous protections and support to agriculture in developed countries (Gawande, 2005: 1; World Bank, 2008b: 4, 96; Yang *et al.*, 2011: 441).

de-Gorter and Swinnen (2002) provided a comprehensive survey of the theoretical and empirical literature on the political economy of agricultural policies, particularly in the developed world. Their survey focused on three approaches: the Becker-Olson-Stigler model of collective action by lobbies; Downs' political-voter interaction models; and the Stigler-Peltzman approach that places different weights on different members of society in the government's objective function (revealed preference approach). They found that agricultural trade and policy reforms were heavily influenced by political elements like lobby groups, and therefore, governments could not easily formulate policy on agriculture without a positive signal from these groups. Similarly, on the basis of the model of de-Gorter and Swinnen, Gawande (2005) carried out a study and found clear evidence of a strong association of political lobbying with agricultural protection.

Similarly, Zahrnt (2009) conducted a survey using three questionnaires and taking a sample of 100 participating foreign missions at the WTO in Geneva. In addition, he interviewed 27 employees from the WTO and national delegations. He found that developed countries' governments neither depended on tariff revenues to finance their budgets nor concerned themselves with limited policy options regarding WTO disciplines and adverse repercussions arising from long-term unemployment. Rather, they were concerned with the bounded rationality of voters – the short-term political costs that could result in defeat in the future election.

However, the scenarios of political pressure on agricultural trade in developing countries are different from those observed in developed countries. Here the political pressure is foreign, rather than domestic, in the form of policies and technologies imposed by developed countries or donor agencies – making agricultural trade of developing countries very difficult, surrounded by a complicated structure and limiting their access to international markets (Acharya, 2011: 60; Bureau, *et al.*, 2005: 12; Gingrich and Garber, 2010: 2; World Bank, 2008b: 42).

The World Bank (2008b) argued that developed countries and international development agencies reduced *Official Development Assistance* (ODA) to agriculture in developing countries during 1990-2008. One of the main reasons for the decline in ODA was opposition from farmers in developed countries to supporting agriculture in their major export markets in developing countries. Furthermore, the World Bank argued that donor countries' tendency to seek 'one-size-fits-all' approaches contributed to poor understanding of agricultural dynamics in developing countries resulting in failure of their imposed policies. Boossabong and Taylor (2009) supported the World Bank's view and criticised 'one-size-fits-all' approaches because of naive assumptions (such as consistent demand for staple food; immobility of crop production; lower income in the agricultural sector; and agricultural problems associated with only soil, water, and plant pests) underlying these approaches which undermined the real complexity associated with agriculture in developing countries.

Developed country agricultural trade policies towards developing countries were politically biased. They granted preferential treatments to particular developing countries, which were based more on political grounds than economic welfare (Anderson, 2003: 12, 13; 2004: 12; Bureau, *et al.*, 2005: 12; Draper and Sally, 2005: 2, 3; Lewis, 2011: 642; Özden and Reinhardt, 2003: 4). For instance, preferential market access and rule of origins often reflect particular political or historical links or strategic relationships or noneconomic reasons (Bureau, *et al.*, 2005: 12; Lewis, 2011: 642; Ludema and Mayda, 2009: 138; Panagariya, 2004a: 5, 6; Williams and Smith, 2008: 3). These issues generated considerable debate in agricultural economics literature. Preferences designed to offer commercial potential to developing countries were much criticised, as they were said to be poorly utilised, in part because the rule of origins governing eligibility were restrictive and they largely limited the benefits of the preferences (Bureau, *et al.*, 2005: 13; Lewis, 2011: 642; VanGrasstek, 2010: 103; Williams and Smith, 2008: 3). Furthermore, developing countries may not achieve as favourable outcomes from these bilateral negotiations or most favoured nation (MFN) arrangements as from multinational negotiations because developed countries dictate and design the terms of trade to serve their own economic and political interests (Bureau, *et al.*, 2005: 13; Lewis, 2011: 641, 642; Williams and Smith, 2008: 3; Zappile, 2011: 46). Developed countries' MFN trade policies were much criticised because of their inadequate support to developing countries' producers to exploit preferences adequately, thereby raising uncertainty about the expiration of preferences and eroding preferential margins (Bureau, *et al.*, 2005: 13; Lewis, 2011: 641, 642; Williams and Smith, 2008: 3; Zappile, 2011: 46).

Therefore, preferences were often tied to restrictive or debatable conditions, were subject to frequent changes, and thus failed to maintain the stable environment necessary to develop a competitive production structure (Bureau, *et al.*, 2005: 13; Lewis, 2011: 641, 642; VanGrasstek, 2010: 105; Williams and Smith, 2008: 3; World Bank, 2008b: 42, 43). There was evidence that these preferences were almost ineffective because of the unrealistic nature of their terms and conditions. For example, the EU's so-called *'Everything but Arms'* preference initiative represents only 0.4 percent of EU agricultural and food imports. Similarly, the *African Growth Opportunity Act* of the USA represents only 0.2 percent of US food imports, and most of them come from the Republic of South Africa (Bureau, *et al.*, 2005: 17; Lewis, 2011: 641, 642; VanGrasstek, 2010: 105; Williams and Smith, 2008: 3; Zappile, 2011: 46).

Moreover, these preferences were accused of providing incentives for a country to specialise in production in which it had no comparative advantage. Furthermore, they were also under serious criticism in the WTO as they contradict the basic normative principle of non-discrimination (Bureau, *et al.*, 2005: 13; Lewis, 2011: 639).

3.6 Agricultural Trade Liberalisation in Bangladesh

3.6.1 Technological Transformation and Welfare: Theoretical Insight

Bangladesh is one of the poorest countries in the world. Compared to the world average per capita income (GNI per capita of US$8741), its per capita income was very low – only US$590 in 2009 (World Bank, 2011d: 306, 307). This figure is slightly above the average of low income countries (US$503) but far below the average per capita income in South Asia (US$1088) (World Bank, 2011d: 306, 307). More than 40 percent of the Bangladesh population live in poverty. Agriculture is an important sector of the economy. It employs 62 percent of the country's workforce (Ministry of Agriculture, 2011: 1). It is the main source of income and livelihood for the rural households who are predominantly poor.

As per arguments for trade liberalisation, agricultural trade liberalisation is likely to direct scarce resources into areas of Bangladesh's comparative advantage, promote specialisation resulting in higher productivity and growth, accelerate investment by allowing access to bigger markets and permit economies of scale, and encourage imports of previously unavailable or scarce capital goods and intermediate inputs for agriculture (Ahmed and Sattar, 2004: 1; McCulloch, *et al.*, 2003: 15, 16; Montalbano, 2011: 1; Stone and Shepherd, 2011: 5; Zhang, 2008: 175). Liberalisation of import markets for fertilisers, pesticides and irrigation equipment might have facilitated farmers' access to the improved production technology, and enabled Bangladesh's agriculture to reallocate resources for specialisation in efficient rice crop cultivation (Ahmed and Sattar, 2004: 1; McCulloch, *et al.*, 2003: 15, 16; Montalbano, 2011: 1; Stone and Shepherd, 2011: 5; Zhang, 2008: 175). However, this argument assumes that resources such as land and labour would be fully employed in the first place, whereas in Bangladesh unemployment is persistently high. Therefore, agricultural trade liberalisation could result in labour temporarily going from low-productivity protected sector to zero-productivity unemployment (Chang, *et al.*, 2005: 2; Chang, *et al.*, 2009: 1; Krugman and Obstfeld, 2006: 405, 406; Panagariya, 2004b: 1150; Stiglitz and Charlton, 2007: 25, 26).

Advocates of free trade argue that agricultural trade liberalisation would produce a knowledge spill-over effect through technological innovation that is embodied in imported machinery, leading to higher growth in Bangladesh's agriculture. This growth would enhance returns to the economy's relatively abundant factor of production – the unskilled labour – by raising real wages for them, thereby contributing to an improvement in income distribution (Ahmed and Sattar, 2004: 2; Gabre-Madhin, *et al.*, 2002: 2; Islam and Habib, 2007: 4; Klytchnikova and Diop, 2006: 6; Lee and Vivarelli, 2006: 7).

On the contrary, the critics of trade liberalisation argued that trade liberalisation could reduce the wages of unskilled labour, thereby widening the income gap between the rich and the poor in the economy (Acharya, 2011: 60; Hoque and Yusop, 2010; Keleman, 2010: 13). Similarly, even if agricultural trade liberalisation brings about higher economic growth through technological transformation, the income gap between the poor and the rich might be widened in the long run because the poor could not afford investments associated with the adoption of new technology to increase production (Acharya, 2011: 60; Banerjee and Newman, 2004: 2; Keleman, 2010: 13; Rakotoarisoa, 2011: 147). Moreover, as the economy is open to global competition, the domestic economic factors are more likely to be influenced by international price shocks and other global variables than by domestic factors (Montalbano, 2011: 8; Sugimoto and Nakagawa, 2011: 12). Thus, there is greater pressure on policy-makers to ensure macroeconomic stability for sustaining economic growth.

Agricultural trade liberalisation may not produce similar welfare impact across all rural households. In practice, some households might have experienced benefit and others might have experienced loss from this liberalisation resulting in diverse distributional consequences across rural households (Hossain and Verbeke, 2010: 77, 78; Isik-Dikmelik, 2006: 3; Klytchnikova and Diop, 2006: 4; World Bank, 2008b: 29, 53). The reason for such possible diverse outcomes can be explained by the fact that agricultural trade liberalisation affects the prices of goods and factors. Thus the changes in prices of goods and factors may diversely affect the welfare of rural households due to their various degrees of involvement with goods and factors markets such as producers or consumers; farm or non-farm households; and net buyers or net sellers (Hossain and Verbeke, 2010: 77, 78; Isik-Dikmelik, 2006: 3; Klytchnikova and Diop, 2006: 4; World Bank, 2008b: 29, 53).

In Bangladesh, amongst agricultural products, rice is dominant in terms of staple food, volume of production and cultivated areas. Therefore, farmers use the main proportion of agricultural inputs such as fertilisers, pesticides, irrigation, and seeds for rice cultivation. From the theoretical point of view, agricultural trade liberalisation may affect productivity of rice farmers through technological transformation. As a result, this may improve producers' welfare through the positive effect on their profits (Anderson, 2004: 1; Klytchnikova and Diop, 2006: 5; OECD, 2010: 11). However, productivity improvement may also translate into lower output prices, which in turn have a negative effect on producer welfare (Anderson, 2004: 1; Gabre-Madhin, *et al.*, 2002: 2; Klytchnikova and Diop, 2006: 5). Some studies such as Byerlee *et al.* (2005); Islam and Habib (2007); Mendola (2007); and Alauddin and Quiggin (2008) argued that gains from new agricultural technology might influence the poor directly by raising incomes of farm households and indirectly by raising employment and wages of functionally landless labourers, and also by lowering the price of food staples.

The majority of farm households in Bangladesh are involved in small and subsistence farming. Thus, at different times of a year, most of the farm households belong to two groups simultaneously: producers and consumers. However, over the course of the year they can be defined as either net sellers or net buyers of rice (Deaton, 1989: 4; Isik-Dikmelik, 2006: 3; Karfakis, *et al.*, 2011: 6, 25; Klytchnikova and Diop, 2006: 5; World Bank, 2008b: 109). An increase in income of net sellers due to an improvement in productivity of rice depends on elasticity of output and elasticity of price. The income of net sellers will rise as long as elasticity of output is greater than elasticity of price with respect to technological change (Isik-Dikmelik, 2006: 3; Karfakis, *et al.*, 2011: 8; Klytchnikova and Diop, 2006: 5; Yu and Fan, 2011: 448). If output increases faster than the price falls in response to technological change, net sellers will enjoy a higher income and welfare, even if some of the gains accrue to net buyers. Therefore, the net effect will depend on whether the household is ultimately a net buyer (subsistence farmer) or a net seller (market-integrated farmer) (Isik-Dikmelik, 2006: 3; Karfakis, *et al.*, 2011: 25; Klytchnikova and Diop, 2006: 5; Yu and Fan, 2011: 448).

Like many other developing countries in the world, the agricultural labour market in Bangladesh is imperfect in terms of competition and mostly seasonal in nature (Ahmed, 1978: 1281; Hossain and Verbeke, 2010: 77; Klytchnikova and Diop, 2006: 6; Stiglitz and Charlton, 2007: 89). Therefore, disguised unemployment and under-employment are the common features of this labour market (Ahmed, 1978: 1281; Briones, 2006: 79; Hossain and Verbeke, 2010: 77; Klytchnikova and Diop, 2006: 6). Similarly, an important characteristic of Bangladesh's agriculture is that households often work on their own farm in subsistence agriculture, rather than working for a wage in the farm or non-farm sectors. Therefore, changes in rice price and productivity induced by technological transformation can affect the implicit trade-off between family work and wage employment (Dorosh and Shahabuddin, 2002: 3; Hossain and Verbeke, 2010: 77; Isik-Dikmelik, 2006: 15; Karfakis, *et al.*, 2011: 3; Klytchnikova and Diop, 2006: 6). By stimulating rice production and the demand for agricultural labour, the lower rice price may benefit the rural poor through the induced wage response and increased real income (Hossain and Verbeke, 2010: 77; Isik-Dikmelik, 2006: 15; Karfakis, *et al.*, 2011: 3; Klytchnikova and Diop, 2006: 6; Ravallion, 1990: 474). From theoretical standpoints, technological improvement is likely to increase productivity of factors and volume of output. However, this increased output is often valued at a lower price, induced by productivity improvement (Gabre-Madhin, *et al.*, 2002: 3; Isik-Dikmelik, 2006: 16; Klytchnikova and Diop, 2006: 6; Stiglitz and Charlton, 2007: 26). Thus, if marginal productivity of factors increases faster than prices fall in response to technological transformation in agriculture, employment and wages will rise simultaneously, benefiting agricultural wage earners (Gabre-Madhin, *et al.*, 2002: 6; Hossain and Verbeke, 2010: 77; Isik-Dikmelik, 2006: 15; Klytchnikova and Diop, 2006: 6). Therefore, agricultural wage earners in Bangladesh might have benefited from technological innovation because of agricultural trade liberalisation.

The impact of technological transformation on the rural livelihoods of Bangladesh's economy may come through an increase in real income resulting from productivity improvement and reduced rice prices (Karfakis, *et al.*, 2011: 4; Klytchnikova and Diop, 2006: 7; Rahman, 2000: 3, 4). With a given demand function of rice, an increase in the volume of rice production (supply) induced by productivity improvement may cause a decrease in the rice price, leading to an increase in real income. This argument is based on the fact that rice is basically a non-traded good in Bangladesh; the price of rice is thereby much more affected by domestic factors than by international price fluctuations (Hossain and Verbeke, 2010: 90; Karfakis, *et al.*, 2011: 23, 24; Klytchnikova and Diop, 2006: 7; Rahman, 2000: 3, 4). Therefore, an increase in the volume of rice production may induce a decline in the rice price, under a given domestic demand function, to attain a new equilibrium in the domestic rice market.

Agricultural trade liberalisation may also affect non-agricultural markets and employment opportunities in rural areas through multiplier effects that are referred to as the consumption growth multipliers. Multiplier effects are agricultural backward and forward production linkages, i.e. increased demand for production inputs such as fertilisers, pesticides and irrigation (backward linkage) and higher demand for processing services such as rice mills and food production from rice (forward linkage) (Klytchnikova and Diop, 2006: 6; OECD, 2010: 5). This linkage-effect plays an important role in stimulating overall growth in the rural economy. Silva and Grossi (2001) found that in Brazil, the rise of rural non-farm enterprises was evident in regions that were mainly agricultural. They argued that the development of agriculture created demand for services to agriculture, leading to the growth of the non-farm sector. Hendriks and Lyne (2003) conducted a study on agricultural growth multipliers for two communal areas of KwaZulu-Natal in South Africa and found that agricultural growth significantly stimulated the development of the non-farm sector. They found that agricultural growth required the adoption of new technology and participation of new markets, leading to the growth of non-farm employment and income through multiplier effects that created both forward and backward linkages to agriculture. Similarly, Klytchnikova and Diop (2006) argued that India experienced a positive multiplier effect of the Green Revolution during the 1960s and 1970s. Similarly, other studies such as Byerlee *et al.* (2005); Valenzuela *et al*. (2005); World Bank (2008b); and Adeoti and Sinh (2009) found that agricultural trade liberalisation had a significant impact on the development of the rural non-farm sector. Therefore, technological transformation in agriculture has the potential to stimulate overall growth of the economy through multiplier effects on rural non-farm employment and incomes as well as on consumers' demand for goods and services outside agriculture.

3.6.2 Agricultural Trade Liberalisation and Environment in Bangladesh

Although agricultural trade liberalisation might have contributed to the productivity improvement and growth in agriculture through technological transformation, there is a growing concern that it could damage the environment of Bangladesh. Some studies such as Pagiola (1995), Hossain *et al*. (2004), World Bank (2006), Dasgupta *et al.* (2004), Alauddin and Quiggin (2008), and Rahman (2010) argued that agriculture damaged the environment through the application of its modern technology and production inputs. These inputs are chemical fertilisers, pesticides, irrigation (groundwater), and HYV rice seeds. There was evidence that intensive agriculture degraded the natural resource-base on which agricultural production mostly depended (Feola and Binder, 2010: 612; Iqbal, 2008: 2661; Matin, 1995: 471; Pagiola, 1995: 5; Rahman, 2010: 254; World Bank, 2006: 61). Pagiola (1995), Rahman (2005), Carvalho (2006), Saha and Ali (2007), and Robbani *et al.* (2007) argued that intensive rice production was posing a constant threat to plants, animals and insect pests as well as to soil fertility through intensive use of chemical fertilisers, pesticides, herbicides and arsenic-contaminated groundwater causing environmental degradation. The rapid increase in the use of pesticides posed threats in two ways: (a) adverse health effects for farm workers and others exposed to pesticides; and (b) contamination of ground and surface water, harming downstream users and damaging inland fisheries.

Therefore, Bangladesh's *National Strategy for Accelerated Poverty Reduction* (World Bank, 2006) cautions that while economic growth is essential to reduce poverty, a careful balancing act must be coordinated, where economic growth is maximised without compromising environmental protection. This strategy explicitly recognises that the poor are dependent on natural resources as well as being vulnerable to environmental health risk (Rahman and Parkinson, 2007: 319; Saha and Ali, 2007: 180; World Bank, 2006: xiii). World Bank (2006) found that environmental impacts accounted for economic losses, equivalent to 4 percent of GDP in 2004. Similarly, other studies such as Dasgupta *et al*. (2005), Nasreen *et al.* (2006), and Robbani *et al*. (2007) supported the World Bank's view and they argued that economic loss incurred in the form of loss of productivity of land and increased health care costs arising from soil and water pollution as a result of inappropriate use of chemical fertilisers, pesticides and irrigation. The incidence of these costs disproportionately falls on the poor because of their vulnerability to environmental health risks (Banerjee and Newman, 2004: 13; World Bank, 2006). Therefore, not only can economic growth compromise environmental protection but in turn, also environmental degradation threatens economic growth.

3.6.3 Study on Agricultural Trade Liberalisation in Bangladesh

Bangladesh has been pursuing the green revolution programme since its independence in 1971 with a view to increasing productivity in agriculture for attaining self-sufficiency in food production. Agricultural trade liberalisation and technological transformation in the 1980s and the early 1990s generated further momentum in Bangladesh's agriculture, resulting in a significant increase in the volume of rice production which led to self-sufficiency in food-grains by the early 1990s (Ahmed and Sattar, 2004: 19; Islam and Habib, 2007: 4; Rahman, 2008: 16).

To date, there has been no systematic and comprehensive study to examine critically the impact of agricultural trade liberalisation on the welfare of rural households of Bangladesh.

Mujeri (2002) argued that while Bangladesh's greater integration into the world economy was generally "pro-poor", the gains were relatively small due to structural bottlenecks and other constraints. In another study, Mujeri and Khondker (2002) found that trade liberalisation stimulated growth in the agricultural sector. However, they did not analyse the impact of agricultural trade liberalisation. Moreover, neither study identified the causes of structural bottlenecks and policy implications in order to resolve these constraints.

The World Bank (2002) showed that the benefits of economic growth during the 1990s had not been distributed evenly across the regions. However, this study did not analyse the reasons and condition of inequality in income distribution. Dorosh and Shahabuddin (2002) found that agricultural trade liberalisation and market deregulation contributed to rice price stabilisation in the 1990s. They argued that price stabilisation following major production shortfalls was largely due to private sector imports. This study did not analyse the impact of rice stabilisation on the welfare of rural households resulting from market deregulation and agricultural trade reforms.

Hossain and Deb (2003) found that trade liberalisation improved productivity in the agricultural sector but Bangladesh did not have a comparative advantage on major agricultural products. Although it had a comparative advantage in the production of high yielding varieties (HYV) of rice, the unit cost of production was relatively high due to government policy. However, this study did not consider the existing constraints towards improving the productivity of factors of rice production such as fragmentation and subdivision of land, or small farming systems that are inappropriate for mechanised cultivation etc. In addition, it neither analysed the adverse government policies that are responsible for high production cost of rice nor indicated any recommendation for alternative policies to increase comparative advantage.

Ahmed and Sattar (2004) discussed agricultural trade liberalisation, but their study did not establish the links between trade liberalisation, growth and poverty. Hossain (2004) found that the long-term trend in agricultural production showed a cyclical pattern with a few years of rapid growth followed by a few years of stagnation. He argued that, since most of the land and other agricultural resources were tied up in rice production, agricultural diversification could not be achieved unless resources were released from rice cultivation. However, he did not analyse how agricultural diversification could be achieved or how it would affect the welfare of rural households in Bangladesh.

The World Bank (2004b) report showed that Bangladesh experienced a significant improvement of the rural non-farm sector in recent years. However, this report did not analyse the multiplier effect of agricultural trade liberalisation through the development of rural non-farm sector, or generation of employment and income in the rural economy.

In another report, the World Bank (2006) argued that trade liberalisation made available cheap imports of agricultural inputs such as pesticides, irrigation equipment, fertilisers and seeds. The report claimed that the application of these inputs affected the environment adversely in the form of loss of soil fertility, loss of bio-diversity and water pollution. However, it did not produce evidence to support this claim and did not seek to establish the links between environmental degradation and technological transformation resulting from agricultural trade liberalisation.

Salim and Hossain (2006) found that there were wide variations in productive efficiency across farms as a result of agricultural reforms. Average efficiency increased modestly from pre-reform to the post-reform period. The efficiency differentials were largely explained by farm size, infrastructure, households' off-farm income, and reduction of government anti-agricultural bias in relation to trade and domestic policies. This study did not analyse the impact of agricultural trade reforms on the welfare of rural households.

Klytchnikova and Diop (2006) found that reform in the agricultural sector contributed significant growth to the economy but its impact on the reduction of rural poverty was considered very insignificant. They argued that agricultural trade liberalisation improved the production of rice considerably, leading to a significant decrease in rice price. They found that net buyers gained and net sellers lost from this process.

However, they did not analyse the impact of agricultural trade liberalisation on the welfare of the rural households in the form of changes in their income and livelihoods.

Rahman (2008) conducted a study on the impact of agricultural trade liberalisation on sugarcane production in two villages of Veramara Upazila in the Kushtia District and on poultry farming in two villages of Savar Upazila in the Dhaka District. He found that trade liberalisation adversely affected the production of sugarcane and increased dependence on sugar imports. Similarly, the previously protected poultry sector became vulnerable because of an increase in input prices resulting from trade liberalisation. However, none of these studies analysed the impact of agricultural trade liberalisation on productivity of these production and the welfare of rural households.

BBS (2009a) found that during last decade significant changes took place in the agricultural sector. These changes included new production structures with a combination of irrigation, fertilisers, high yielding varieties of seeds and pesticides, and mechanisation in land preparation. All these changes contributed to an increase in production of food-grains in Bangladesh. This study provided basic statistical information on the number of agricultural holdings, their area, and size; tenancy; irrigation status; land ownership; land use; agricultural labour force; and other agricultural information such as poultry, livestock, fishery, and forestry. This is a routine census by the government to collect and supply agricultural statistics. Like other studies, this study also did not analyse the impact of these changes on the welfare of rural households.

Nahar and Siriwardana (2009) conducted an ex-ante analysis using a computable general equilibrium (CGE) model and found that the complete removal of import tariffs could reduce absolute poverty for all groups, both in rural and urban areas. However, they did not conduct an ex-post analysis (real scenario), nor did they undertake direct interviews with rural households to determine the level of poverty reduction.

Hossain (2009) found that agricultural trade liberalisation contributed to the development of minor irrigation dominated by shallow tube-wells leading to the expansion of Boro rice cultivation. Consequently, rice production increased significantly. However, this study did not extend to examine how these productivity improvements impacted on the welfare of rural households.

Hossain and Verbeke (2010) found that agricultural trade liberalisation contributed to the integration of rice markets across the six regions (divisions) and therefore the long-run equilibrium was stable. Conversely, in the short run the market integration as measured by the magnitude of market interdependence and the speed of price transmission between the divisional markets was weak. However, they did not analyse how agricultural trade liberalisation affected prices of rice through market integration and in turn how changes in the rice price affected the welfare of rural households.

Alam, *et al.* (2011) attempted to analyse the welfare impact of policy interventions in food grain markets during 1980–2003. They argued that the loss in consumer surplus exceeded the gain in producer surplus from government control over food grain markets, resulting in a deadweight loss for the society. Conversely, they further argued that the gain in consumer surplus and government revenue from liberalisation of foodgrain markets was greater than the loss in producer surplus, implying a net welfare gain to the society. However, they did not analyse the impact of these policy interventions on the welfare of different groups of rural households. Similarly, Karfakis *et al*. (2011) attempted to identify the impact of rice price changes on household welfare. They argued that rural households exhibited higher welfare losses than urban households from an increase in the rice price. However, they also did not analyse how a change in the rice price affected different groups of rural households such as farmers and non-farmers; large, medium, and small farmers; farmers and agricultural labourers; and net sellers and net buyers.

The common gaps of these studies are as follows:

Firstly, although, all studies attempted to shed some light on poverty, agricultural trade liberalisation, agricultural policy reforms, market deregulation, and rural development, none of them analysed the impact of agricultural trade liberalisation on the welfare of rural households. Some of the factors that may influence the aspects of welfare of rural households as a result of agricultural trade liberalisation include changes in: productivity of agriculture; rice prices (consumer and producer prices); household income and expenditure; poverty, inequality, and income distribution; environment; the development of the non-farm sector; infrastructure; use of natural resources, etc.

Secondly, the scope as well as the terms and conditions of these studies were often defined to suit the intention of the sponsors for specific development programmes and projects, particularly studies financed through foreign aid (e.g. World Bank, DFID, ADB etc.). Consequently, these studies paid more attention to macroeconomic outcomes than to investigate the welfare implication of those policies and reforms on livelihoods of rural households.

Thirdly, based on the reports of the World Bank, the donor agencies put enormous pressure on government to withdraw subsidies from fertilisers, diesel, and high yielding variety seeds, which caused a major problem for small and marginal farmers in crop production. As a result, small farmers faced numerous constraints in meeting production cost.

Finally, these studies did not directly speak with poor-rural households because foreign consultants and their local counterparts limited their activities to urban-based policy makers.

Based on the above situations, this study seeks to address the following research question: how has agricultural trade liberalisation influenced the welfare of rural households in Bangladesh? To help answer this research question the study analysed the impact of agricultural trade liberalisation on the welfare of rural household through changes in productivity of rice; prices (consumer and producer prices) of rice; income distribution; poverty and inequality; and environment. These analyses are presented in the subsequent chapters of this study

This study hopes to contribute to the discussions and debates on the impact of the agricultural trade liberalisation process through conceptual, theoretical, and empirical analysis of the experience of Bangladesh. This will help to enrich the conceptual and contextual knowledge regarding the impact of agricultural trade liberalisation on the welfare of rural households. The next chapter discusses the methodology including the theoretical and empirical framework of this PhD study.

CHAPTER FOUR

Methodology and Study Design

4.1 Introduction

The preceding chapter reviewed theoretical and empirical literature on agricultural trade liberalisation. This chapter presents the methodological framework and research design of this PhD study. It discusses the selection of research design, theoretical frameworks, empirical models, and techniques applied for addressing the research question for this study.

4.2 Rationale for Selection of Research Design

Research Methods

There are three main research paradigms: quantitative, qualitative, and mixed method. This study applied mixed method research – a combination of the elements of both quantitative and qualitative methods for the broad purposes of breadth and depth of understanding and corroboration with a view to providing a better understanding of the research problem and better addressing the research questions than either method alone (Greene, 2008: 8; Johnson *et al.*, 2007: 123; Turner, *et al.*, 2008: 6). The advantage of a mixed method research is that it combines the strengths of both quantitative and qualitative approaches and uses multiple worldviews or paradigms rather than the typical association of certain paradigms related to quantitative and qualitative approaches (Greene, 2008: 8; Johnson, *et al.*, 2007: 123; Turner, *et al.*, 2008: 6).

Ex-ante and Ex-post Analysis

Analysis of the impact of agricultural trade liberalisation on household welfare may be divided into two broad approaches: ex-ante analysis – measuring the impact of proposed trade liberalisation using pre-liberalisation data, and ex-post analysis – using data before and after trade reforms (Isik-Dikmelik, 2006: 2; Klytchnikova and Diop, 2006: 2). Some ex-ante studies included Minot and Goletti (2000), Porto (2003), Nicita (2004), Dercon (2006), and Turner, *et al.* (2008). Some ex-post studies included Clarere (2005), Isik-Dikmelik (2006), Klytchnikova and Diop (2006), Narayanan, *et al.*

(2010), and Lima *et al.* (2011). The advantage of ex-post analysis over ex-ante analysis lies with its nature of investigation, which considers the state of household welfare in both pre-liberalisation and post-liberalisation periods. Therefore, this study employs the ex-post analysis using data from both pre-liberalisation and post-liberalisation periods with a view to presenting a comparative analysis between pre-liberalised and post-liberalised scenarios of household welfare.

Single Model versus Multiple Models

Gravity models and computable general equilibrium (CGE) models are widely used for measuring the impact of trade liberalisation. While the former are mostly used for measuring welfare effects from specific bi-lateral or regional preferential trading agreements such as the formation of free trade areas and custom unions, the latter are used for measuring welfare impacts from unilateral or global trade liberalisation. However, CGE models are often criticised as they are extremely complex; depend on parameters and functions that may be difficult to estimate; are highly sensitive to the assumptions and model specifications; often focus on sectors in which poor people have little involvement; and frequently rely on the concept of a single 'representative' household (Gotor and Tsigas, 2011; Musonda and Wanga, 2006: 571; Narayanan, *et al.*, 2010: 764; Turner, *et al.*, 2008: 7). The construction of a CGE model requires considerable resources such as data from all sectors of the economy. In addition, such models are not easily understood by non-technicians who are involved in the policy formulation process (Turner, *et al.*, 2008: 7). Although CGE models are now routinely used for the evaluation of trade policy reforms, yet they are typically highly aggregated – shortcomings of their usefulness in measuring impacts of trade liberalisation at the household level (Musonda and Wanga, 2006: 571; Narayanan, *et al.*, 2010: 764; Turner, *et al.*, 2008: 7). Thus, both gravity and CGE models have shortcomings in capturing the impact of trade liberalisation on household welfare.

Many studies applied multiple models and multiple estimation techniques to overcome shortcomings associated with a single model for measuring the impact of trade liberalisation. Some of these studies included Bhattacharyya (2006), Samuel (2007), Boossabong and Taylor (2009), Pupongsak (2009), Kazungu (2009), Morrissey and Leyaro (2009), Teweldemedhin (2009) Urassa (2010), Leyaro and Morrissey (2010), and Akapaiboon (2010).

This PhD study employs multiple models and multiple mathematical, statistical, and econometric estimation tools and techniques for critically examining the impacts of agricultural trade liberalisation with a view to overcoming limitations of methodological frameworks associated with a single model and technique and to producing broader pictures of changes in the welfare of rural households. These models and techniques are discussed in the following sections of this chapter.

4.3 Theoretical and Empirical Frameworks of the Study

4.3.1 Theoretical Framework: Welfare Analysis and Its Dimensions

The study investigated the changes in welfare of rural households. Here the changes in welfare were measured through the changes in productivity and price of rice as a result of agricultural trade liberalisation. The study assumed that households were uniform in terms of rational behaviour – they wanted to maximise their welfare subject to their budget and resource constraints. The term 'welfare' was treated as the meaning conveyed by the concepts 'satisfaction', 'well-being' and 'utility' that are used in economics and other social sciences (Conceição and Bandura, 2008: 2; Strengmann-Kuhn, 2000: 2).

Household welfare is dependent on a bundle of goods that includes services. The welfare function may differ across the rural households and across circumstances, indicating that the same bundle of goods may produce different levels of welfare. Thus, the welfare function depends not only on the bundle of goods but in some cases also on age, health status, employment status and other socio-economic factors. Therefore, the study considered these factors in analysing household welfare.

The study used income and consumption to measure economic welfare, as they capture the means by which households can achieve welfare. Income and consumption tend to highly correlate with each other because consumption depends on income (Strengmann-Kuhn, 2000: 2; Wagle, 2007: 75).

In most empirical studies, income is the only indicator used for household welfare and resources (Wagle, 2007: 75). This PhD study used both measures – income and consumption – to analyse household welfare with a view to producing better results (Strengmann-Kuhn, 2000: 8). This study considered consumption as a combination of the bundle of purchased goods and household’s own produced goods consumed by that household as well as other goods transferred to the household.

The study examined the effects of changes in both consumer and producer prices of rice on the distribution of real income across different households of rural communities. It analysed the consumption and production patterns of rice in relation to household characteristics, particularly the types of households and their living standards, with a view to providing an easily comprehended map of the effects of price changes. As Deaton (1989) assumed, household expenditure per head (xpc) is used as a preferred measure of household living standards and is measured as total household expenditure on non-durables per month divided by the number of persons in a household. A simple representation of household living standards is given by the following indirect utility function.

$$u_h = \varphi(wT + b + \pi, \boldsymbol{P}),$$

where u_h is utility (or real income) of household h, w is the wage rate, T is the total time available, b is the rental income, property income, or transfers, $\boldsymbol{P}$ is the price vector of commodities consumed, and π is the household's profits from farming or other family business. Since profits are maximised, π is assumed as the value of a profit function, $\boldsymbol{n}(\boldsymbol{p}, \boldsymbol{v}, \boldsymbol{w})$, where $\boldsymbol{v}$ is the vector of input prices, $\boldsymbol{w}$ is the wage rate, or vector of household wages, and $\boldsymbol{p}$ in this context is the vector of output prices for commodities such as rice that are produced by the household. A standard property of the profit function is that

$$\partial n/\partial p_i = y_i,$$

where y_i is the (gross) production of good i by the household. Given these functions, the effects of price changes on household real income are straightforward to derive. In particular, we have

$$\frac{\partial u_h}{\partial p_i} = \frac{\partial \varphi}{\partial b}\frac{\partial n}{\partial p_i} + \frac{\partial \varphi}{\partial b} = \frac{\partial \varphi}{\partial b}(y_i - q_i), \tag{3}$$

where q_i is consumption of good i, and the last step in the equation comes from the use of Roy's identity (Allenby *et al.*, 2004: 97; Deaton, 1989: 3; Landry and McConnell, 2007: 253, 256) .

Since the welfare of different households generally weighs differently in the rice price changes due to changes in productivity as a result of agricultural trade liberalisation, it is reasonable to move from household to social welfare by writing, for social welfare *W*:

$$\partial W/\partial p_i = \sum_h \theta_h\,(y_{ih} - q_{ih}); \quad \theta_h = {}^{\partial W}\!/_{\partial b_n} = \left({}^{\partial W}\!/_{\partial u_n}\right)\left({}^{\partial u_n}\!/_{\partial b_n}\right)$$

So that θ_h is a weight that represents the social value of transferring one taka (Bangladesh currency) to household h.

Instead of looking at the change in welfare associated with a price change, it can be measured by identifying how much money (positive or negative) the household would require to maintain its previous level of living standard. If the price change is dp_i, and the required compensation is *dB*, then

$$dB = (q_i - y_i)dp_i = p_i(q_i - y_i)d\ ln\ p_i\ ;$$

so that, if *dB* is expressed as a fraction of household expenditure x, we have

$${}^{dB}\!/_{x} = (w_i - p_i y_i/x)\ \ d\ ln\ p_i,$$

where $(w_i - p_i y_i/x)$ is the budget share of good *i*, and $p_i y_i/x$ is the value of production of *i* as a fraction (or multiple) of total household expenditure. The term $(w_i - p_i y_i/x)$ is the *net consumption ratio,* which is the elasticity of the cost of living with respect to the price of good *i*.

The effect through prices is two-fold: the effect on income (direct price effect on income from the commodity) and the effect on the expenditure through the consumption effect. Therefore, the first-order effect of a change in food prices on household welfare depends on the net trading position of the household. Deaton (1989) formalised this situation with the concept of net benefit ratio (NBR), which is a proxy for the net-trading position of a household, to estimate the first-order impacts of price changes on household welfare. The net benefit ratio for a commodity is the difference between the production ratio (PR) (value of production as a proportion of income, or expenditure) and consumption ratio (CR) (value of consumption as a proportion of income, or expenditure) of that commodity. It is the proportion of net sales to income or expenditure and is approximated by the difference between income share of the commodity and consumption share of the commodity.

Following the Deaton's (1989) methodology, Klytchnikova and Diop (2006), and Isik-Dikmelik (2006) expressed as follows:

$$NB = (PR - CR) = \frac{p_i^p q_i}{X} - \frac{p_i^c y_i}{X} ;$$

where q_i is the production and y_i is the consumption, X is the total income and p_i^p and p_i^c are producer and consumer prices respectively. The *NB* is used to determine net seller and net buyer households. Deaton (1989) introduced this methodology and used it for analysing the impact of changes in rice prices on household welfare in Thailand. Later, this methodology is used by many studies to determine net sellers and net buyers for analysing changes in household welfare resulting from trade reforms. Some of these studies included Budd (1993) in Cote d'Ivoire, Benjamin and Deaton (1993) in Cote d'Ivoire, Barrett and Dorosh (1996) in Madagascar, Porto (2003) in Argentina, Nicita (2004) in Mexico, Porto (2005) in Mexico, Isik-Dikmelik (2006) in Viet Nam, Klytchnikova and Diop (2006) in Bangladesh, Ural (2007) in India, Arndt et al.(2008) in Mozambique, and Vu and Glewwe (2011) in Viet Nam.

The Deaton's (1989) methodology is simple to understand household welfare under a basis of microeconomics framework. This PhD study used this approach to determine households' involvement in rice market – either net sellers or net buyers.

4.3.2 Empirical Frameworks of the Study

This study used both mathematical and econometric techniques to estimate the impacts of agricultural trade liberalisation on the welfare of rural households. It attempted to investigate multidimensional aspects of the impact of agricultural trade liberalisation on the welfare of rural households in Bangladesh in the following two broad contexts: changes in productivity and prices of rice. It also examined the effects of changes in productivity and the prices of rice on household income and consumption; and income distribution, inequality and poverty in the rural economy. These changes are multidimensional in nature. Therefore, this study used multiple mathematical and econometrical models to achieve its objectives.

4.3.2.1 Changes in Productivity of Rice

The changes in productivity of rice affect the changes in rice production leading to changes in the welfare of farm households. An increase in the volume of rice production reflects positive impacts of agricultural trade liberalisation on the welfare of farm households, and vice versa. The study examined the changes in productivity of rice through analysing the changes in the following variables and factors.

4.3.2.1.1 Technological Transformation

Agricultural trade liberalisation has facilitated technological transformation in agriculture. The study examined the nature of technological transformation that has taken place in rice production through analysing the changes in the use of the following factors of production:

(a) irrigation;
(b) fertilisers;
(c) high yielding variety (HYV) seeds; and
(d) pesticides.

4.3.2.1.2 Cropping Intensity

The study analysed the changes in cropping intensity and cropping patterns of rice due to technological transformation as a result of agricultural trade liberalisation. The changes in cropping intensity were measured by using conventional cropping intensity index (CII). CII was calculated by the sum of areas (land) planted with different rice crops and harvested in a single year, divided by the total rice-cultivated areas times 100 (Ray *et al.*, 2005: 477). Cropping patterns of rice were measured by establishing the proportion of total rice cropland occupied by individual rice crops (such as Aus, Amon, and Boro). The changes in cropping patterns are measured by changes in cropping pattern ratio (CPR). CPR is calculated by the sum of areas planted with individual rice crops and harvested in a single year, divided by total rice cropland in the same year times 100 (Carlyle, 2002: 76).

4.3.2.1.3 Partial Factor Productivity

The study analysed the partial factor productivity (PFP) measurement approach to estimate productivity of rice. PFP refers to the productivity of one single factor input. It is calculated as a ratio of total output to total of a factor input (land, labour, capital, or organisation separately) for a particular year (Windle and Dresner, 1992: 437).

From the literature review, it is understood that agricultural trade liberalisation has its first impact on productivity of factors through bringing about a reallocation of resources. According to trade liberalisation arguments, the agricultural sector is supposed to be more competitive in the post-liberalisation period than before. Therefore, the study analysed the changes in productivity of factors of production – land, labour and capital inputs (irrigation, fertilisers, pesticides, and seeds) as well as changes in the pattern of their usage in rice production.

4.3.2.1.4 Total Factor Productivity

The study measured total factor productivity (TFP)-growth of rice. TFP-growth shows the relationship between the growth of output and the growth of input with the influence of technology and technical efficiency. It is generally calculated as a residual (Englander, 1988: 6; Hisali and Yawe, 2011: 14). Solow (1957) introduced the measurement of productivity growth and technical progress which was associated with a production function/cost function/profit function.

For the TFP-growth measurement, economists developed many techniques such as index number approaches including Malmquist productivity index (Caves *et al.*, 1982: 1394; Färe and Grosskopf, 1992: 158), Solow's residual (Raa and Shestwova, 2006: 3; Solow, 1957: 312), Törnqvist productivity index (Caves, et al., 1982: 1394) , and Fisher ideal index (Färe and Grosskopf, 1992: 158); stochastic production frontier estimation techniques (Sharma et al., 2007: 218); Monte Carlo simulation techniques (Slade, 1986: 76); translog production function (Chang and Hu, 2010: 3263); growth accounting matrix (Griliches, 1996: 1324); and Durenberger productivity indicator (Barros et al., 2011: 642).

Both mathematical and econometric models are used to measure TFP-growth. Using mathematical models, there are four main approaches to the measurement of TFP-growth namely: (a) Solow's residual analysis, (b) the index number approach, (c) input-output analysis, and (d) Data Envelopment Analysis (DEA) (Raa and Shestwova, 2006: 1).

The Malmquist productivity index is a widely-used index number approach because it is simple to measure, easy to understand, and produces reliable results. It provides high accuracy, has minimum restrictions for model specification, and is easy to decompose into two major components: technical efficiency change, and technological change – the main sources of TFP-growth. Similarly, the DEA method is a commonly used technique for the measurement of TFP-growth. The main advantage of using the DEA method is that it avoids model misspecification (Cook and Zhu, 2005: 1). This is a scale-neutral method using the measurement of inputs and outputs based on linear programming techniques. (Chang and Hu, 2010: 3263).

This PhD study used the DEA method to calculate the Malmquist productivity index (TFP) with a view to identifying sources of productivity growth and efficiency in rice production. The advantage of the DEA-based Malmquist productivity index is that it calculates the efficiency of factors or inputs. The output-oriented factor-efficiency measures the maximum output from a given input. Similarly, input-oriented efficiency measures the use of minimum input to produce a given output. It is related to returns to scale such as increasing, constant, and decreasing return to scale.

This study adopted the pioneering works of Färe and Grosskopf (1992), and Färe *et al.* (1994) as below:

The production possibility set-

$$S^t = \{(x^t, y^t): x^t\ can\ produce\ y^t\},$$

where time period t = 1, 2 ...T. The technology is assumed to have standard properties such as convexity. The production (output) sets are defined in terms of S^tas:

$$P_t(x) = \{y^t: (x^t, y^t) \in S^t\}.$$

The successive production sets are essentially independent from each other. However, there is a certain form of dependence between sequential production sets across time. This dependence is based on the assumption that production units can always produce the same amount of outputs given the same amount of inputs what they have done before in the production processes (Färe and Grosskopf, 1992: 159; Färe, *et al.*, 1994: 68; Yuk-Shing, 1998: 7). Thus, the construction of the latest set requires information on the previous period's inputs and outputs for measuring productivity performance.

In order to calculate the Malmquist productivity index using sequential DEA approach, the output distance function for each time period, *t*, can be written as follows:

$$d^t(x^t, y^t) = \min\left\{\lambda : \left(y^t/_{\lambda}\right) \in p_t^{seq}(x)\right\};$$

where superscript P_t^{seq} denotes sequential output set. When λ is minimised, then y^t/λ is maximised. Thus, this distance function measures the maximum possible output with a given input vector x^t and technology under period t. Therefore, the Malmquist productivity index can be defined as follows (Färe and Grosskopf, 1992: 159; Färe, *et al.*, 1994: 70):

$$M(x^t, y^t, x^{t+1}, y^{t+1}) = \frac{d^t(x^t, y^{t+1})}{d^{t+1}(x^{t+1}, y^{t+1})} \times \left[\frac{d^{t+1}(x^t, y^t)}{d^t(x^t, y^t)} \times \frac{d^t(x^{t+1}, y^{t+1})}{d^{t+1}(x^{t+1}, y^{t+1}}\right]^{1/2};$$

where, in the right hand side of the equation, the ratio outside the square brackets measures the change in technical efficiency between two periods (years), *t* and *t+1*. The geometric mean of the two ratios inside the square brackets captures the shift in technology between the two periods. In order to calculate output-oriented Malmquist productivity index under the assumption of constant return to scale (CRS) technology four distance functions are required to be calculated as follows:

$$\left[d_c^{t+i}(x_{\acute{k}}^{t+j}, y_{\acute{k}}^{t+j})\right]^{-1} = \max_{\theta, z_k^s} \theta^{\acute{k}},$$

subject to

$$-\theta^{\acute{k}} y_{\acute{k},m}^{t+j} + \sum_{s=1}^{t+i}\sum_{k=1}^{K} z_k^s\, y_{k,m}^s \geq 0, \quad m = 1, \ldots \ldots, M$$

$$x_{\acute{k},n}^{t+j} - \sum_{s=1}^{t+i}\sum_{k=1}^{K} z_k^s\, x_{k,n}^s \geq 0, \quad n = 1, \ldots \ldots, N$$

$$z_k^s \geq 0, \quad k = 1, \ldots \ldots, K, and\ s = 1, \ldots \ldots, T + i,$$

where

$$\left[d_c^t(x_{\acute{k}}^t, y_{\acute{k}}^t)\right]^{-1} \quad is\ calculated\ with\ (i,j) = (0,0);$$

$$\left[d_c^{t+i}(x_{\acute{k}}^{t+1}, y_{\acute{k}}^{t+1})\right]^{-1} is\ calculated\ with\ (i,j) = (1,1);$$

$$\left[d_c^t(x_{\acute{k}}^{t+1}, y_{\acute{k}}^{t+1})\right]^{-1} \quad is\ calculated\ with\ (i,j) = (0,1);$$

$$\left[d_c^{t+1}(x_{\acute{k}}^t, y_{\acute{k}}^t)\right]^{-1} \quad is\ calculated\ with\ (i,j) = (1,0);$$

where subscript c denotes the CRS benchmark technology. The symbols K, N, M and T represent total number of farms, inputs, outputs and time periods respectively. The symbol θ denotes a scalar of the proportional expansion in output for a given input vector and z_k^s is an intensity variable indicating at what intensity production unit k may be employed in production.

4.3.2.1.5 Rice Production

The study analysed the following four aspects of rice production:

(a) volume of rice production;

(b) share of local varieties;

(c) share of HYV; and

(d) growth of rice production.

4.3.2.1.6 Determinants of Output

The study used econometric models and applied ordinary least square (OLS) regression techniques to estimate determinants of rice output. The rationale for using OLS is that it is simple and easy to estimate and it has some strong theoretical properties – the OLS estimators have minimum variance in the class of linear estimators under certain given assumptions of the classical regression model. The OLS estimators are the best linear unbiased estimators (BLUE) (Greene, 2007: 890; Gujarati, 2006: 174; Maddala, 2008: 112).

The study used both input and output models to investigate the impacts of particular input and output on total rice production. It used Cobb-Douglas (C-D) production function to estimate determinants of output. The C-D production function can be written as follows:

$$Y = AL^{\propto}K^{\beta};$$

where Y is total output, L is labour input, K is capital input, A is technology, and α and β are the partial elasticities of labour and capital respectively. These values are constant and are determined by available technology. Further, if:

$$(\alpha + \beta) \quad \begin{cases} > 1\text{: increasing return to scale;} \\ = 1\text{: constant return to scale; and} \\ < 1\text{: decreasing return to scale} \end{cases}$$

The above equation can be re-written as follows:

$$Y = \beta_1 X_{2t}^{\beta_2} X_{3t}^{\beta_3}$$

This equation can be expressed as a log-transformation or log-linear regression model as follows:

$$LnY = A + \beta_2 LnX_{2t} + \beta_3 LnX_{3t} + u_t;$$

where u_t is the error term.

The study disaggregated capital input into irrigation, fertilisers, pesticides and seeds with a view to identifying their individual impact on rice output. It also included land in the model because land is an important factor of rice production. Therefore, the model can be re-written as follows:

$$LnY = A + \beta_2 LnX_{2t(land)} + \beta_3 LnX_{3t(labour)} + \beta_4 LnX_{4t(irrigation)} + \beta_5 LnX_{5t(fertilisers)} + \beta_6 LnX_{6t(pesticides)} + \beta_7 LnX_{7t(seeds)} + u_t;$$

4.3.2.2 Changes in Rice Prices and Household Income and Consumption

The study focused on the impact of agricultural trade liberalisation on the changes in prices of agricultural products. Proponents of trade liberalisation argue that it is supposed to make the factors more competitive and efficient resulting in an outward or upward shift in rice production possibility frontier, leading to a downward (right) shift of supply function of rice. Given the demand function, a downward shift of the supply curve should push the domestic price down to settle at a new equilibrium point because rice is a non-exported good in Bangladesh as the government imposed restrictions on rice exports. Thus, the study explored the implications of the changes in price of rice by focusing on two types of prices, namely: producer price and consumer price.

The study deflated current prices to base year prices by using the producer price index and the consumer price index from various statistical yearbooks of the Bangladesh Bureau of Statistics (BBS). It examined the effects of changes in producer and consumer prices of rice on the distribution of real income across different groups of rural households, by describing consumption and production patterns of rice in relation to household characteristics, particularly types of households and their living standards.

4.3.2.2.1 Changes in Income

4.3.2.2.1.1 Growth in Household Income

The study measured growth in real income by quintiles of the different groups of rural households. It measured the ordinary growth rate, pro-poor growth rate and growth rate in mean as defined and calculated by Ravallion and Chen (2003), and Ravallion (2004).

Ordinary Growth Rate (g_t):

$$g_t = \left(\frac{y_t - y_0}{y_0}\right) \times 100;$$

where y_t is the income of period 2 (current year income) and y_0 is the income of period 1 (base year income).

Growth Rate at Quintile p:

$$g_t(p) = \left[\frac{y_t(p)}{y_{t-1}(p)}\right] - 1, \qquad with\, p = 1, \ldots., 5;$$

where p represents a quintile.

Growth Rate at Mean Income:

$$g_{t(avg)}(hh) = \left[\frac{y_{t(avg)}(hh)}{y_{t-1(avg)}(hh)}\right] - 1;$$

where *(hh)* represents a particular household group (such as small farmer, agricultural labourer, net seller etc.), $y_{t(avg)}(hh)$ is the average income of current period *(t)* for a particular group of household and $y_{t-1(avg)}(hh)$ is the average income of base period $(t-1)$ for a particular group of household.

Pro-poor Growth Rate:

$$g_t(pp) = \frac{1}{5}\sum_{i=1}^{5} g_t\,(p_i);$$

where $g_t(p_i)$ represents the quintile growth rate of *ith* quintile for a particular group of rural households. In fact pro-poor growth rate is the mean of quintile growth rates.

Decomposition of Income Growth

The study presented the actual changes in each income source for all rural households by decomposing the growth in real income by sources. The sum of these changes constitutes the growth in real income. The study has decomposed the growth in real income by six sources of income such as agriculture, wage and salary, business and commerce, house rent, gift-remittance-assistance, and other sources as divided by the Bangladesh Bureau of Statistics in HHES 1985-86 and HHIES 2005.

The study first measured the actual growth of each of these sources. Then it summed up all individual growth rates from all sources. It divided each source's growth rate by the summed-value of their total growth for calculating the weight of each source's growth to the total growth. The study multiplied the calculated weight of each source by the actual growth in mean income experienced by all rural households as a group. The decomposition of income growth by sources provided insights into the components of the actual income growth experienced by rural households.

4.3.2.2.1.2 Determinants of Household Income

The study investigated what characteristics of rural households were associated with the growth in welfare. It used econometric models to establish relationships between income and various household characteristics. It considered both economic and non-economic characteristics of rural households. It used the ordinary least square (OLS) regression estimation technique to identify the determinants of income of rural households.

The study has constructed regression models as defined and used by Dercon (2006), and Isik-Dikmelik (2006). The model for estimation is as follows:

$$log(y_{h,t}) = \mu_h + \varphi X_{h,t} + \epsilon_{ht};$$

where, $log(y_{h,t})$, the dependent variable, is the real income (logarithm) of the rural households; $\mu_h$is the intercept of the regression line; and $\varphi X_{h,t}$ is the explanatory variables which influence household income. The last components of the model ϵ_{ht} represent the error terms. In the above equation, μ and φ are called the parameters, also known as regression coefficients.

This study extended the above model by separating household economic and non-economic characteristics (endowments). Thus, the model can be rewritten as follows:

$$log(y_{h,t}) = \mu_h + \varphi_{(econ)} X_{(econ)h,t} + \varphi_{(non-econ)} X_{(non-econ)h,t} + \epsilon_{ht};$$

The components $X_{(econ)h,t}$ and $X_{(non-econ)h,t}$ are the independent (explanatory) variables that represent household economic and non-economic characteristics respectively. Similarly, $\varphi_{(econ)}$ and $\varphi_{(non-econ)}$ are the coefficients of economic and non-economic variables respectively.

Household economic characteristics include land ownership and income shares from agriculture, wage-salary, business-commerce, house rent, gift-remittance-assistance, and other sources. Similarly, other economic characteristics include some dummy variables such as whether the household is landless or not, farmer or not, small farmer or not, medium farmer or not, large farmer or not, and agricultural labourer or not. On the other hand, household non-economic characteristics include household size and type; and household head's gender, education and employment status.

4.3.2.2.1.3 Determinants of Household Income Growth

The study estimated the determinants of the growth in real income of rural households. It used OLS to estimate semi-log and log-linear models as specified by Isik-Dikmelik (2006) for identifying determinants of the income-growth. It considered household characteristics for period 1 (base year) as initial endowments and for period 2 (current year) as current endowments of rural households. The dependent variable is the change in real income that implies growth in income. The model specification is as follows:

$$\Delta \log y_{h,t} = \alpha + \beta X_{h,t_0} + \delta X_{h,t_1} + \gamma \Delta X_h + \varepsilon_{h,t} \;;$$

where $\Delta \log y_{h,t}$ is the difference between log income of current year and log income of base year; X_{h,t_0} is the matrix of household characteristics for period 1 (base year) or initial endowments (household size and type; household head's age, gender and education; land etc.), X_{h,t_1} is the matrix of household characteristics for period 2 (current year) or current endowments, ΔX_h is the matrix of changes in endowments (change in shares of income from different sources, etc.), and $\varepsilon_{h,t}$ represents the error terms. This specification allows the study to examine the relationship between endowments and the change in welfare or growth in real income of rural households.

4.3.2.2.2 Changes in Consumption

4.3.2.2.2.1 Growth in Household Consumption

The study mostly used the ordinary least square (OLS) regression estimation technique to identify the determinants of consumption of rural households. It also used the Two-stage Least Square regression technique applying instrumental variables to estimate elasticities and determinants of households consumption with a view to avoiding endogeneity problems associated with endogenous relationship between income and consumption.

The study measured growth in consumption by quintiles of the different groups of rural households. It used the same approaches and estimation techniques as used in the case of measuring growth in real income in the previous subsection 5.3.2.2.1.1 of this chapter. Similarly, it used same OLS model specifications for estimating determinants of household consumption and consumption-growth as used in the case of estimating determinants of income and income-growth in the previous subsections 5.3.2.2.1.2 and 5.3.2.2.1.3 of this chapter.

4.3.2.3 Poverty, Inequality and Growth

Agricultural trade liberalisation may contribute to economic growth, but that growth may not be completely translated to poverty reduction because of existing inequality. Furthermore, population growth may slow down poverty reduction, which is ignored in the literature. This study will consider this factor.

4.3.2.3.1 Measuring Inequality

Generalised Entropy (GE)

The study measured Generalised Entropy (GE) following Haughton and Khandker (2009: 106) approach:

$$GE(\alpha) = \frac{1}{\alpha(\alpha-1)}\left[\frac{1}{N} \times \sum_{i=0}^{N}\left(\frac{y_i}{\bar{y}}\right)^{\alpha} - 1\right];$$

where *N* is the number of individuals in the sample, y_i is the income of individual *i*, and $\bar{y}$ is the per capita mean income (or expenditure). The parameter *α* in *GE(α)* represents the weight given to distances between incomes at different parts of the income distribution and can take any real value. However, the most common values of α used are 0, 1 and 2. *GE(α=0)* is sensitive to changes in the lowest tail, *GE(α=1)* is sensitive to changes in the middle part and *GE(α=2)* is sensitive to changes in the highest tail of the distribution.

Growth-Inequality Decomposition

The study measured the sectoral decomposition of changes in poverty by farm and non-farm households as introduced by Datt and Ravallion (1992) and as applied by Ravallion and Datt (2002), Ravallion and Chen (2003), and Ravallion (2004).

The growth-inequality decomposition quantifies the relative conditions of economic growth and redistribution to changes in poverty (Datt and Ravallion, 1992: 277). It can explain whether changes in welfare distribution have offset gains from economic growth in reducing poverty.

$$P_{t_n} - P_{t_0} = G(t_0, t_n; r) + D(t_0, t_n; r) + R(t_0, t_n; r)$$

The growth component: $G(t_0, t_n; r) \equiv P\left(\frac{z}{\mu_{t_n}}, L_r\right) - P\left(\frac{z}{\mu_{t_0}}, L_r\right)$

The redistribution component: $D(t_0, t_n; r) \equiv P\left(\frac{z}{\mu_r}, L_{t_n}\right) - P\left(\frac{z}{\mu_r}, L_{t_0}\right)$

The residual: $R(t_0, t_n; r)$ represents interaction term not represented by the other two components.

where $P_{t_n} - P_{t_0}$ is the changes in poverty, t_n is the final year of the period, t_0 is the initial year of the period, and r is the reference year at which the welfare distribution and mean welfare are held constant (fixed). Similarly, z is poverty line, μ is the mean income or consumption, L is the Lorenz curve.

4.3.2.3.2 Poverty and its Measures

The study measured poverty indices following approaches as used by Haughton and Khandker (2009). These indices are illustrated below.

4.3.2.3.2.1 Headcount Index (P_0)

The study measured the headcount index using the Haughton and Khandker (2009) approach:

$$P_0 = \frac{N_p}{N};$$

where P_0 is headcount index or poverty, N_p is the number of poor, and N is the total population. This equation can be rewritten as below:

$$P_0 = \frac{1}{N}\sum_{i=1}^{N} I\,(y_i < z);$$

where, z represents the poverty line, $I(y_i < z)$ is an indicator function that takes on a value of 1 if the bracketed expression is true, and 0 otherwise; y_i is consumption expenditure. The study used poverty lines *(z)* as used by the Bangladesh Bureau of Statistics during HHES 1985-86 and HHIES 2005. If individual consumption (y_i) is less than poverty line (z), then $I(y_i < z)$ equals 1 and the person would be counted as poor.

4.3.2.3.2.2 Poverty Gap Index (P_1)

The poverty gap index is measured as follows:

$$P_1 = \frac{1}{N}\sum_{i=1}^{N} \frac{G_i}{z} ;$$

where $G_i$is the poverty gap and can be measured as follows: $G_i = (z - y_i) \times I(y_i < z)$.

4.3.2.3.2.3 Squared Poverty Gap Index (P_2)

Similarly, the squared poverty gap index is measured as follows:

$$P_2 = \frac{1}{N}\sum_{i=1}^{N} \left[\frac{G_i}{z}\right]^2 ;$$

4.3.2.3.2.4 Sectoral Decomposition of Changes in Poverty

The study measured the sectoral decomposition of changes in poverty by farm and non-farm households as introduced by Ravallion and Huppi (1991) as follows:

$$P_{t_n} - P_{t_0} = \sum_k (s_{t_0 k})(P_{t_n k} - P_{t_0 k}) + \sum_k (s_{t_n k} - s_{t_0 k})(P_{t_0 k}) + \sum_k (s_{t_n k} - s_{t_0 k})(P_{t_n k} - P_{t_0 k})$$

where, $P_{t_n} - P_{t_0}$ is change in poverty;

$\sum_k (s_{t_0 k})(P_{t_n k} - P_{t_0 k})$ is intra-sectoral component;

$\sum_k (s_{t_n k} - s_{t_0 k})(P_{t_0 k})$ is inter-sectoral (population shift) component; and

$\sum_k (s_{t_n k} - s_{t_0 k})(P_{t_n k} - P_{t_0 k})$ is interaction component.

4.3.2.3.2.5 Growth Elasticity of Poverty

The study used the growth elasticity of poverty (ε) as defined by Bourguignon (2002: 8), and Haughton and Khandker (2009: 168). It is measured as follows:

$$\varepsilon = \frac{\partial P}{\partial Y}\frac{Y}{P} ;$$

where P is the headcount index and Y is the per capita income or consumption.

4.4 Types of Data and Their Sources

4.4.1 Rationale for Data Use

The study used data from both primary and secondary sources to achieve its objectives. There are requirements for data sets from at least two distinct time-periods to measure the impact of agricultural trade liberalisation on the welfare of rural households. The study used secondary data for measuring household welfare. However, secondary data could not provide this study with all necessary information such as the impact of agricultural trade liberalisation on the environment, rural infrastructure, and socio-economic conditions of the rural economy. Appropriate data from secondary sources were not available to analyse these impacts. Thus, the study conducted a primary survey to collect primary data for critical examination of the multidimensional aspects of the welfare of rural households.

4.4.2 Secondary Data Sources

The sources of secondary data included relevant published documents and previous studies of a theoretical and empirical nature, as well as data from different national and international sources.

4.4.2.1 Data on Input and Output of Rice

This study used time series data on input and output of rice from the *Handbook of Agricultural Statistics 2007* (Ministry of Agriculture, 2007), and *Bangladesh Economic Review* 2008, 2009 and 2010 (Ministry of Finance, 2008, 2009, 2010). It also used data from various statistical yearbooks of the BBS. These data were in both aggregated and disaggregated forms, such as total rice production (aggregated) and distribution of total rice production by three main rice crops – Aus, Amon, and Boro (disaggregated).

4.4.2.2 Household Income and Consumption Data

The study used data on household income and consumption from various household surveys of the BBS including *Household Income and Expenditure Survey 2005* (BBS, 2007b), *Household Income and Expenditure Survey 2000* (BBS, 2003), *Household Expenditure Survey 1995-96* (BBS, 1998), *Household Expenditure Surveys 1985-86* (BBS, 1988), and various statistical yearbooks of Bangladesh. It also used data from the World Bank, the UNDP, the WTO, and the IMF.

4.4.2.3 Limitations of Secondary Data on Household Income and Consumption

The study encountered limitations in the use of secondary data due to a lack of disaggregation. The aggregate data approach uses summaries and thus cuts out much variation, resulting in higher correlations than with disaggregated data. In HHIES 2005, all households were aggregated under 19 income or expenditure groups. For the purpose of regression and poverty analyses, this study overcame this limitation by disaggregating household data into 100 observations using respective household groups' weight (percentage share) as the basis for disaggregation. For instance, in HHIES 2005, households having income between TK3000 and TK3999 represented 14.87 percent of the total households (BBS, 2007b) and they were disaggregated into 15 observations (households) having similar distance of income between two observations. This disaggregation is based on the assumption that keeping the same average income-distance between two observations will not change the original characteristics of the data.

I have also conducted a *Data Exploratory Analysis* to identify outliers. I found two outliers in the data set of HHES 1985-86 and these outliers were dropped from the data set. However, I found no outlier in the data set of HHIES 2005.

4.4.3 Primary Data

4.4.3.1 The Need for the Use of Primary Data

The above data from secondary sources could not provide all information necessary for this study. The missing information included: characteristics of different groups of rural households such as farmers and non-farmers; their involvement with rice markets such as household rice selling and buying behaviours; their involvement in non-farm activities; characteristics of rice cultivation and input usages; costs of rice production; impacts of rice cultivation on natural resources and the environment; transportation and rural infrastructure; and changes in other socio-economic conditions in the rural economy as a result of agricultural trade liberalisation.

Furthermore, while secondary data provide aggregate information on inputs such as fertilisers, pesticides, irrigation and HYV seeds, they do not give details on some of the issues examined by the study, for instance reasons why farmers use particular types of fertilisers, how they use pesticides, and why they engaged too much land in rice cultivation but not in other agricultural activities. In order to overcome the above data constraints, I undertook a fieldwork to collect primary data from a village of Comilla Sadar Upazila in the Comilla District of Bangladesh.

4.4.3.2 Methods of Primary Data Collection

4.4.3.2.1 Research Design: Survey Methods

The study used a mixed method research design in primary data collection. Questionnaire and face-to-face interview techniques were used for collecting primary data. A structured survey questionnaire was designed with both closed-ended and open-ended questions. Therefore, the datasets included both quantitative (closed-ended) information through using a closed-ended checklist and qualitative (open-ended) information through interviews with participants. The choice of this method was warranted to achieve the objectives of the study.

The household head or a senior person of the household who had access to information of all household members answered this structured interview questionnaire. I conducted this structured interview through asking participants the questions and writing their answers. If a participant did not have information about all members of the household, the participant was not requested to participate in the survey.

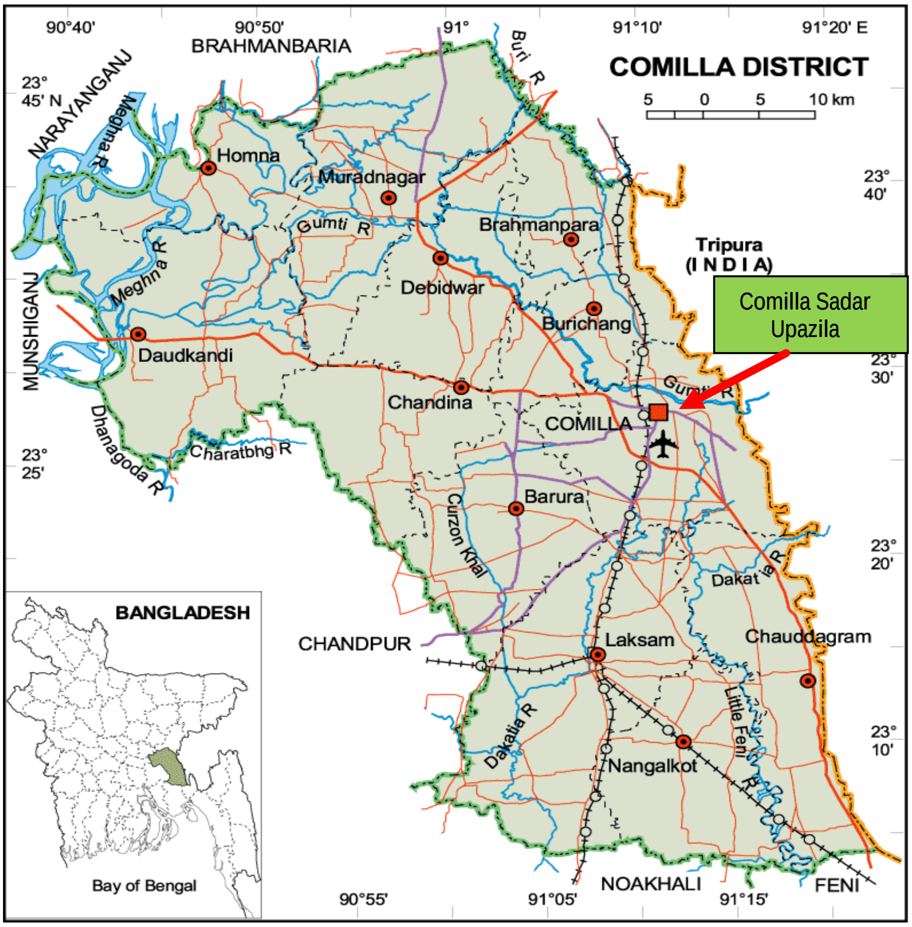
4.4.3.2.2 Sampling Methods and Sample Size

The study used both probability and non-probability sampling methods for field survey to collect primary data. Using *convenience* and *judgment sampling*, non-probability sampling methods (Bartlett-II *et al.*, 2008: 47), it selected Comilla amongst the sixty-four districts of Bangladesh for conducting the field survey.

1. Comilla was a pioneer district in the field of the *Green Revolution* in Bangladesh. It was expected that it might have experienced significant technological transformation in agriculture as a result of agricultural trade liberalisation.
2. It is basically an agricultural district. It is neither a hilly nor a coastal area, representing the typical geographical feature, which is conducive to agricultural activities. Therefore, data would not be affected by geographical bias. The farmers of this district produce three crops of rice – Aus, Amon, and Boro, representing the basic characteristics of rice cultivation in Bangladesh.
3. The *Bangladesh Academy for Rural Development* (BARD), a research institute for agriculture and rural development, is located in the Comilla district. The BARD and other research institutes usually conduct surveys in this district and the participants are familiar with surveys and research. Therefore, it was expected that conducting a field survey in this district would present fewer logistical challenges.

According to the Bangladesh Bureau of Statistics (BBS, 2007a), there are thirteen upazilas (sub-districts) in the Comilla district. They are: 1) Barura, 2) Brahmanpara, 3) Burichang, 4) Chandina, 5) Chauddagram, 6) Daudkandi, 7) Debidwar, 8) Homna, 9) Comilla Sadar, 10) Laksam, 11) Meghna, 12) Muradnagar, and 13) Nangalkot.

Map 4.1: The map of the Comilla District



Source: http://www.banglapedia.org/httpdocs/Maps/MC_0308.GIF [Retrieved: 20 May 2011]

The study selected Comilla Sadar Upazila, then Chouara Union from that upazila and finally one village from that union for conducting the field survey[1]. Based on cluster sampling, the households of the selected village were divided into three clusters (A, B and C) and then, using the random sampling technique, the cluster C was selected for the field survey. The study surveyed all 60 households from this cluster. Therefore, the sample size of this survey was 60 households of that village. The details of observations are presented in Table 4.1.

[1] The name of the village is not identified in the thesis as restrictions imposed in the ethics application.

Table 4.1 Distribution of observations by household types: HHS 2010

Households	Observations
Total	**60**
Farm	52
Non-farm	8
Distribution of Farm- households	
1. Farmer	38
2. Agricultural labourer:	14
Distribution of Farmers	
1. Small farmer	30
2. Medium farmer	7
3. Large farmer	1

As mentioned earlier, I conducted this survey. If a participant did not have information about all members of the household, the participant was not requested to participate in the survey. Therefore, all 60 observations for all questions were found correct/valid and no sample was dropped from the original data set. I also conducted a *Data Exploratory Analysis* to identify outliers and no outlier was found in this data set.

Map 4.2: Comilla Sadar Upazila showing Chouara Union

Source: http://www.banglapedia.org/httpdocs/Maps/MC_0310.GIF [Retrieved: 20 May 2011]

4.6 Analytical Techniques

The literature review showed that agricultural trade liberalisation could produce diverse welfare-impacts across rural households. Some households might have experienced benefits and others might have experienced losses. This is because agricultural trade liberalisation affects both goods and factor prices, which in turn affect household welfare in different ways, depending on their different characteristics (Nicita, 2009: 19).

Rural households were divided into five sub-groups (quintiles) using income:

(i) Bottom 20 percent (Quintile 1),
(ii) Lower middle 20 percent (Quintile 2),
(iii) Middle 20 percent (Quintile 3),
(iv) Upper middle 20 percent (Quintile 4), and
(v) Top 20 percent (Quintile 5).

They were further classified on the basis of their involvement in farming activities, namely:

(i) Farm households, and
(ii) Non-farm households.

Other classification included:

(i) Farmers, who owned farm land, and
(ii) Agricultural labourers.

Farmers were further divided into three sub-groups based on their farm size (as used by the BBS during the Household Income and Expenditure Survey 2005, and Agricultural Sample Survey 2005):

(i) Small Farmers (0.05-2.49 acres),
(ii) Medium farmers (2.50-7.49 acres), and
(iii) Large farmers (7.5 acres and above).

Finally, households were classified on the basis of their participation in the rice market either as

(i) Net buyers or
(ii) Net sellers.

The study used four main analytical software including SPSS for estimating OLS and Two-stage Least Square regression models, DEAFrontier for estimating total factor productivity, ADePT for measuring poverty and inequality, and Excel for a variety of estimation and computation purposes.

4.7 Conclusion

The analytical framework presented in this chapter was designed to provide a better understanding of the empirical methods and techniques consistent with theoretical contexts. It combined mathematical and econometric estimation techniques to map out the possible impacts of agricultural trade liberalisation on the welfare of rural households. The following chapter presents field data collected from 60 households in Comilla Sadar Upazila in January-February 2010, focusing specifically on household characteristics and rice cultivation.

CHAPTER FIVE

Agricultural Trade Liberalisation: Rice Cultivation and Characteristics of Rural Households

5.1 Introduction

Having discussed the methodology and data collection in the preceding chapter, Chapter 4, this chapter focuses on two key features of the research data for this PhD thesis, namely the characteristics of rural households, and rice cultivation.

The analysis is undertaken at two levels. Firstly, a general analysis of rural households and rice cultivation is conducted for all of Bangladesh from secondary data from a variety of sources. Secondly, the above analysis provides a basis for critical examination of these characteristics at the local community level of the case study village in Comilla Sadar upazila of the Comilla district. These analyses provide the foundation for subsequent analysis of changes in rice productivity and household welfare presented in the following chapter, Chapter 6. Household characteristics examined include household types, farming activities, land ownership, characteristics of dwellings, demographic and educational characteristics, and household involvement in the rice market.

5.2 Household Characteristics

Households are the basic economic and social units in rural Bangladesh. They consist of farm and non-farm households. They carry out all rural economic activities related to production and consumption.

5.2.1 Types of Rural Households

A household is a dwelling unit where one or more persons live and eat together under a common food arrangement (BBS, 2007b: 147). The rural households in this study were divided into two broad categories: farm and non-farm households. Farm households are those households whose main source of income is from farming activities. Farm households included farmers and agricultural labourers. Agricultural labourer households are those households whose main source of income is from wages of agricultural labour. Non-farm households are those households whose main source of income is from non-agricultural activities such as business and investment in the non-farm sector (BBS, 2007b: 147).

In 1985-86, the proportions of farm and non-farm households were 74 and 26 percent respectively. This proportion changed slightly to 77 and 23 percent respectively in the interviewing year, 2010.

Table 5.1: Distribution of rural households

Household types	Percent of households			
	1985-86	1995-96	2005	2010*
Farm households	74	72	74	77
Non-farm households	26	28	26	23

Source: Author's calculation from various household surveys of BBS, * HHS-2010 conducted by the author

Farm households were grouped under four sub-categories based on the size of their cultivable land: small farmers, medium farmers, large farmers, and agricultural labourers (Table 5.2). In the period 1985-86 and 2010, nearly 58 percent of farm households consisted of small farmers, while another 27 percent were agricultural labourers. Together these two groups constituted about 85 percent of all rural households in Bangladesh. There was a sharp decline in the ratio of large and medium farmers by an average of –2.91 and –0.52 percent per year during the same period respectively.

Despite the decline in large and medium farm households, only a slight increase was observed in small farmer and agricultural labourer households. This may be an indication that large and medium farmers may be sub-dividing their cultivable land as their children leave the household and set up their own households. This could lead to gradual transformation of large and medium farm households into small farmers. For the same reasons, some small farmers may be either sub-dividing their farm with their grown children who set up their own households or transform to agricultural labourers.

Table 5.2: Distribution of farm households

Household types	Cultivable land *(in acre)*	Percent of farm households				Average change per year (%)**
		1985-86	1995-96	2005	2010*	
Large farmers	7.50 and +	7.04	3.66	2.78	1.92	-2.91
Medium farmers	2.50-7.49	15.50	14.63	14.17	13.47	-0.52
Small farmers	0.05-2.49	53.52	59.76	57.33	57.69	0.31
Agricultural labourers	0.04 and less	23.94	21.95	25.72	26.92	0.50

Note: ** Changes shown between years 1985-86 and 2010
Source: Author's calculation from various household surveys of BBS, * HHS-2010 conducted by the author

5.2.2 Rural Households and Land Ownership

The characteristics of rural households by ownership of land are shown in Table 5.3. According to the Bangladesh Bureau of Statistics (BBS, 2007b), a household having an average land area of 0.04 acre or less was considered as landless and 0.05 acre or above was considered as a land-owner. In 1985-86, the ratios of landless and landowner households were 15 and 85 percent respectively. In 2010, the ratio of landless households increased to 23.8 percent and the ratio of landowner households decreased to 76.2 percent. The landless households increased by an average of 2.35 percent per year between 1985-86 and 2010. On the other hand, the ratio of landowner households decreased by an average of –0.41 percent over the same period.

Table 5.3: Household type by land ownership: 1985-86 to 2010
(in percent)

Household type	1985-86	1995-96	2005	2010*	Average change per year (%)**
Landless	15	18	14	23.8	2.35
Land owner	85	82	86	76.2	-0.41

Note: ** Changes shown between years 1985-86 and 2010
Source: Author's calculation from various household surveys of BBS, * HHS-2010 conducted by the author

The descriptive statistics of land ownership of the rural households is presented in Table 5.4. The mean, standard deviation, skewness, and kurtosis are used for exploring the characteristics of the data and their distribution. The mean measures the average value of data. The standard deviation shows how much variation or dispersion there is from the average (mean) value. A low standard deviation indicates that the data points tend to be very close to the mean; whereas a high standard deviation indicates that the data is spread out over a large range of values. The skewness measures how data are distributed around the centre. In a normal distribution, the mean and the median are equal with a symmetric distribution; therefore, the skewness is zero. If the mean is greater than the median then the data distribution is right skewed. On the other hand, if the mean is smaller than the median then the skewness is negative. This situation refers to left skewed distribution. The greater the difference between the mean and the median, the more skewed the distribution. The kurtosis measures the sharpness of the peak of distribution of data. A low kurtosis distribution has a more rounded peak and shorter and thinner tails; while a high kurtosis distribution has a sharper peak as well as longer and fatter tails.

The average (mean) size of household land gradually decreased from 1985-86 through to 2010. In 1985-86, the mean was 1.65 acre and in 2010, this value was reduced to 1.34 acre. This decline is because the amount of land is fixed but the number of households increased because of an increase in population growth and new household formation. The values of standard deviation for all years are relatively large compared to their respective mean suggesting that the range of data is high and dispersed far from the mean. The positive values of skewness and kurtosis for all years suggest that the distribution of land amongst the rural households was not normal and symmetric. For all years, the values of skewness were positive, indicating that the mean was greater than its corresponding median, thus making the distribution of land right skewed. Similarly, the values of kurtosis for all years were very high in the table suggesting that the distribution of land amongst the rural households was sharply peaked. This data suggests that the distribution of land amongst farm households is not a normal distribution.

Table 5.4: Household land ownership: 1985-86 to 2010

(in acres)

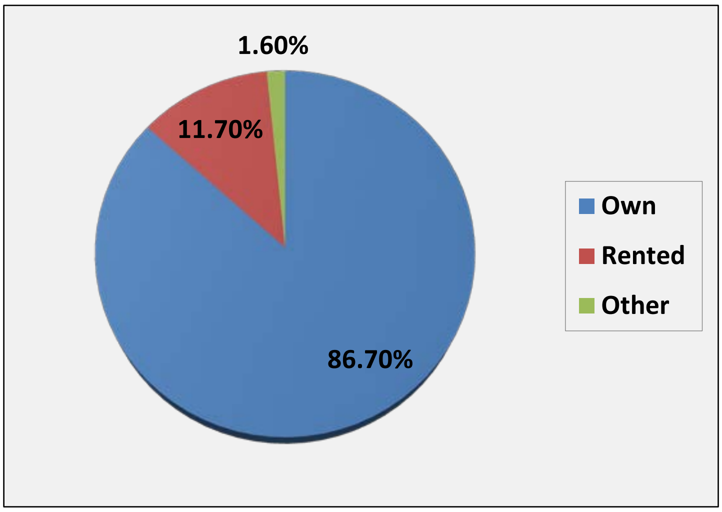
Statistical measures	1985-86	1995-96	2005	2010*
Mean	1.65	1.56	1.36	1.34
Standard deviation	3.72	3.54	2.19	2.18
Skewness	4.85	4.69	3.67	3.17
Kurtosis	27.24	26.12	17.16	11.64

Source: Author's calculation from various household surveys of BBS, * HHS-2010 conducted by the author

5.2.3 House Ownership

Considering ownership of the dwelling houses, the majority of rural households lived in their own houses as revealed in HHS-2010. Amongst them 86.7 percent lived in their own houses, 11.7 percent lived in rented houses, and 1.6 percent lived in another category of ownership (such as rent-free relatives' houses) as shown in Figure 5.1.

Figure 5.1: Dwelling house by ownership: 2010



Source: Author's calculation from HHS-2010 conducted by the author

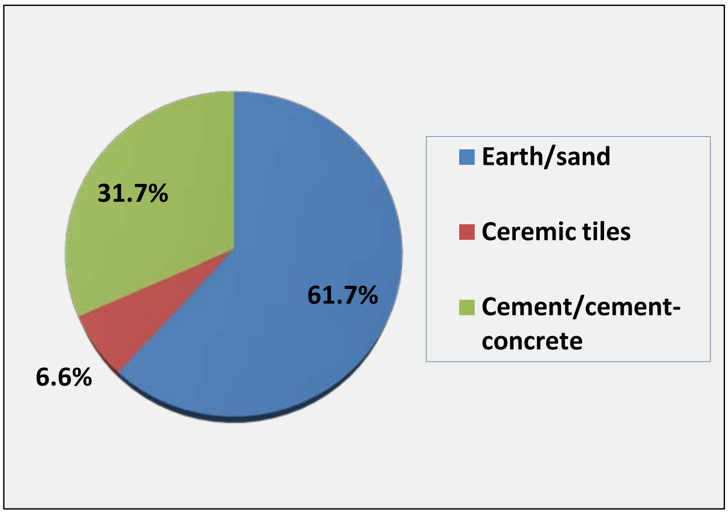
5.3 Characteristics of Dwelling Houses

The dwelling houses are portraits of socio-economic conditions of rural households. As revealed in HHS-2010, a large number of rural households built their houses from naturally-available materials such as earth/sand, wood, bamboo, and straw. They were bound to use these natural materials because they were poor and could not afford modern house-building materials. The characteristics of the dwelling houses in terms of their floors, walls, roofs, and room numbers are discussed in the following sections.

5.3.1 House Floors

The rural households used earth/sand, ceramic tiles, and cement-concrete as materials for the house floor. As presented in Figure 5.2, 61.7 percent of the dwelling house floors were made of earth/sand. Only 6.6 percent of the dwelling house floors were made of ceramic tiles. The rich households owned the houses with ceramic floors. The remaining 31.7 percent of house floors were made of cement or a mix of cement and concrete.

Figure 5.2: Materials of house floors: 2010

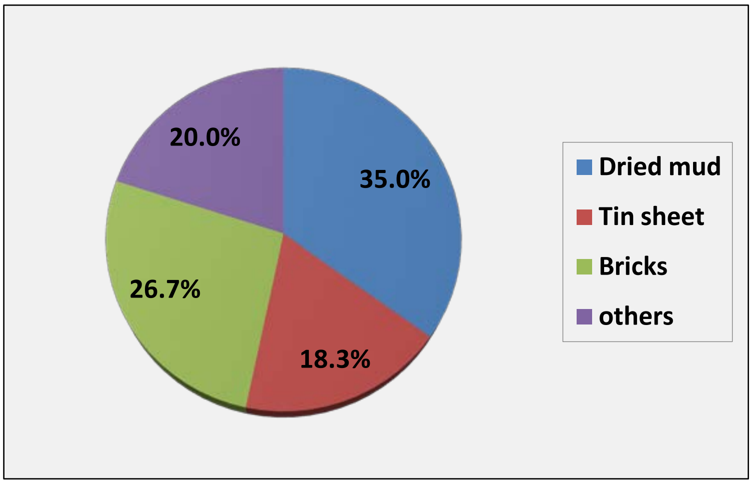


Source: Author's calculation from HHS-2010 conducted by the author

5.3.2 House Walls

The house walls of the rural households were made of dried mud, tin sheet, and bricks covering 35.0, 18.3, and 26.7 percent respectively as shown in Figure 5.3. The remaining house walls covering 20.0 percent of total houses were made of other materials including cane, palm trunks and leaf, jute sticks, and sods.

Figure 5.3: Materials of house walls: 2010

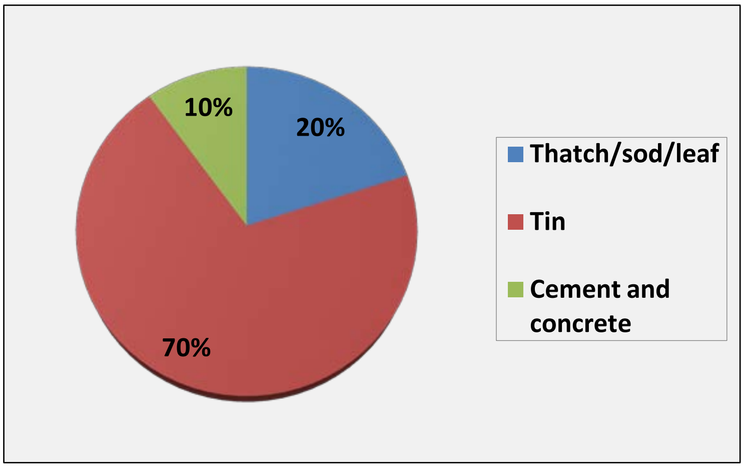


Source: Author's calculation from HHS-2010 conducted by the author

5.3.3 House Roofs

In 2010, 20 percent of the house roofs were made of thatch/sod/leaf. The majority of the house roofs were made of tin, covering 70 percent of the total houses in the rural areas. The remaining 10 percent of house roofs were made of cement and concrete.

Figure 5.4: Materials of house roofs: 2010

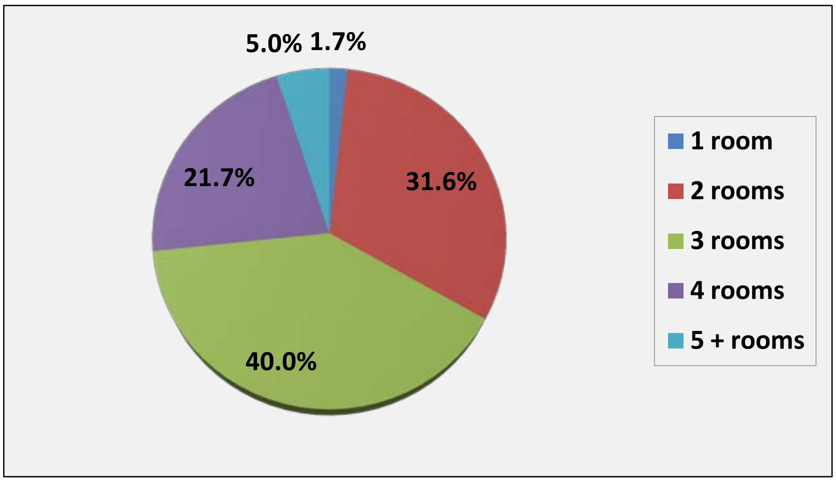


Source: Author's calculation from HHS-2010 conducted by the author

5.3.4 House Room Numbers

The size of houses ranged from 1 to 5 rooms. In 2010, 71.6 percent of houses were medium-sized having 2 and 3 rooms.

Figure 5.5: House room numbers: 2010



Source: Author's calculation from HHS-2010 conducted by the author

5.4 Demographic Characteristics of Households

5.4.1 Age and Gender

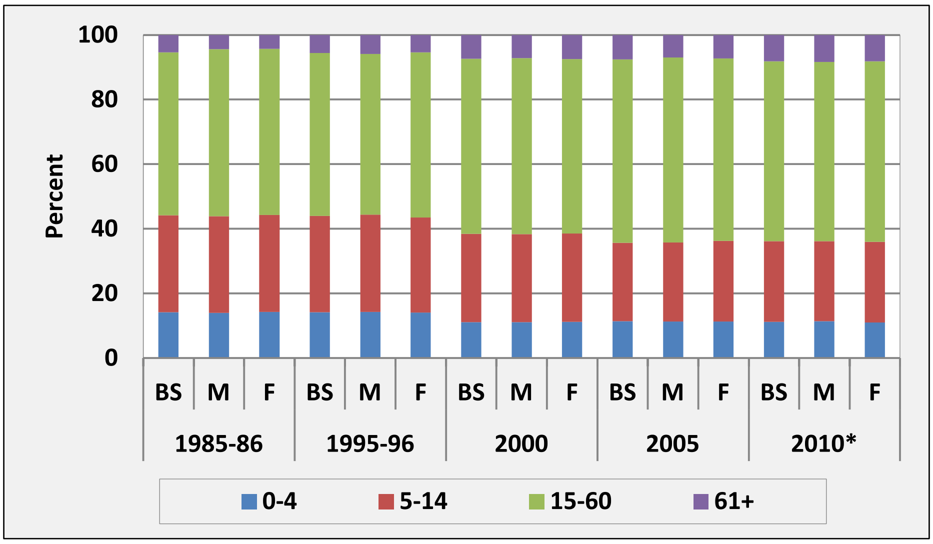
The distribution of population by age and gender helps understand determinants of the welfare of rural households by revealing the characteristics of working and dependent populations. The patterns of distribution of population by age and gender were very similar between 1985-86 and 2010 as presented in Figure 5.6. Both male and female populations had similar pattern of distribution by age groups.

The distribution of population was categorised into the following age groups: 0-4, 5-14, 15-60, and 61+ years representing pre-school, school, working, and retired populations respectively. Age groups 0-4 and 5-14 represent younger dependants while the age group 61+ represents the older dependant population. Conversely, the age group 15-60 years represented the labour force of the rural economy.

The proportion of the younger dependant population gradually declined and the share of the working population gradually increased during 1985-86 to 2010. The younger dependant groups showed a declining trend, suggesting a lower population growth in 2010 than in 1985-86. On the other hand, the older dependant population showed an increasing trend, implying that the retired-age population gradually increased during the same period. These two opposite trends of population change suggest that the government should gradually experience higher health-care expenditure for older dependant population.

This distribution suggests that the majority of population were young – the main elements of the labour force in the economy.

Figure 5.6: Distribution of rural population by age and gender: 1985-86 to 2010



Note: Legend shows age groups, BS – both sex, M – male, and F – female

Source: Author's calculation from BBS Table 2.6 HHIES 2005, Table 2.6 HHIES 2000, Table 2.6 HHES 1995-96, Table 2.6 HHES 1985-86, and * HHS-2010 conducted by the author

The male and female population ratios seemed to be balanced across the years during 1985-86 to 2010 as shown in Table 5.5.

Table 5.5: Gender ratio of rural population: 1985-86 to 2010

Gender	1985-86	1995-96	2000	2005	2010*
Male	51.28	50.84	50.84	50.64	49.20
Female	48.72	49.16	49.16	49.36	50.80

Source: Author's calculation from BBS HHIES 2005, HHIES 2000, HHES 1995-96, HHES 1985-86, and * HHS-2010 conducted by the author

6.4.2 Gender of Household Heads

Typically, rural households in Bangladesh are male-headed because the male adult in the family is considered the most influential person in the household in terms of income earning and decision-making. Most female-headed households would be the result of either the death of male-heads, separation, or divorce. The ratio of male and female household heads did not change significantly during 1985-86 to 2010, and male-headed households dominated at between 89-92 percent in this period as shown in Table 5.6

Table 5.6: Gender of rural household heads: 1985-86 to 2010

(in percent)

Gender	1985-86	1995-96	2000	2005	2010*
Male headed	91	90	91	89	92
Female headed	9	10	9	11	8

Source: Author's calculation from BBS HHIES 2005, HHIES 2000, HHES 1995-96, HHES 1985-86, and * HHS-2010 conducted by the author

5.4.3 Household Size

Household size is an important determinant of welfare of rural households because it may influence a household's income and expenditure. Household size refers to the total number of members of a household. Table 5.7 presents the percentage distribution of rural households by the household size. In 1985-86, the largest share of household size was 6+ with a proportion of 41.78 percent of the total households. However, the largest share of household size gradually shifted from 6+ to 4-5 members per household group.

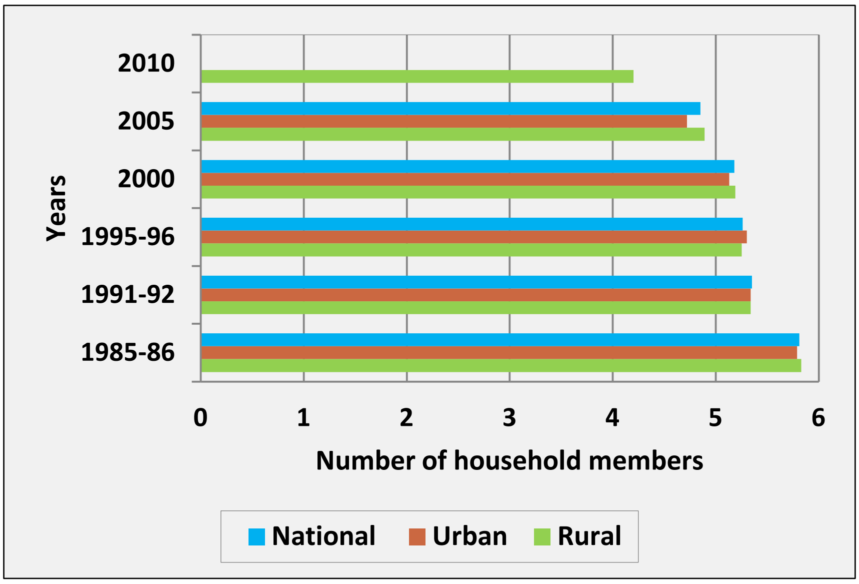
Table 5.7: Percentage distribution of rural household by household size

Household size (Numbers of members)	1985-86	1995-96	2000	2005	2010*
1	2.05	2.38	1.75	2.34	1.72
2-3	21.74	19.52	18.70	22.17	25.02
4-5	34.43	38.99	41.58	43.31	40.05
6+	41.78	39.10	37.97	32.18	33.21

Source: Author's calculation from BBS HHIES 2005, HHIES 2000, HHES 1995-96, HHES 1985-86, and * HHS-2010 conducted by the author

As calculated, the average household size in rural areas also declined steadily from 5.83 in 1985-86 to 4.20 in 2010. The average household size for the national rural and urban category is presented in Figure 5.7

Figure 5.7: Average household size: 1985-86 to 2010



Source: Author's drawing using data from BBS (Table 2.1 of HHIES 2005, HHIES 2000, HHES 1995-96, HHES 1985-86); and HHS-2010 conducted by the author

5.5 Educational Characteristics of Households

An analysis of the educational characteristics of rural households examined the education of heads of the household, adult literacy, and literacy by regional distribution.

5.5.1 Education of the Head of Households

Table 5.8 shows that majority of heads of the household were illiterate. The literacy rate of household heads at the rural, urban, and national level was 46.0, 67.0, and 51.9 percent respectively in 2005. In 1985-86, 38 percent of rural household heads were literate while 62 percent were illiterate. This proportion changed significantly, almost reaching a balance between literate and illiterate household heads by 49.6 and 50.4 percent respectively. During 1985-86 to 2005, the literacy rate of household heads for rural, urban, and national levels increased by an average of 1.05, 1.78, and 1.55 percent per year respectively. Conversely, the illiteracy rate of household heads for rural, urban, and national levels decreased by an average of –0.65, –1.10 and –1.02 percent per year respectively. This analysis suggests that the increase in the literacy rate of household heads was slow during that period.

Table 5.8: Educational characteristics of household heads: 1985-86 to 2010

(in percent)

	Literacy	1985-86	1995-96	2000	2005	2010	*Avg. changes per year (%)
Rural	Literate	38.0	41.0	40.9	46.0	**49.6**	**1.05**
	Illiterate	**62.0**	**59.0**	**59.1**	**54.0**	**50.4**	**-0.65**
Urban	Literate	58.5	63.5	60.2	67.6		**1.78**
	Illiterate	**41.5**	**36.5**	**39.8**	**32.4**		**-1.10**
National	Literate	39.6	45.3	44.9	51.9		**1.55**
	Illiterate	**60.4**	**54.7**	**55.1**	**48.1**		**-1.02**

Note: * changes shown between 1985-86 and 2005

Source: compiled and calculated (bold) from BBS HHIES 2005, HHIES 2000, HHES 1995-96, and HHES 1985-86; and HHS-2010 conducted by the author

5.5.2 Adult Literacy

The Bangladesh Bureau of Statistics (BBS, 2007b) defined adult literacy as the population aged 15 years and over who can read, understand, interpret, communicate and compute in verbal and written forms in varying contexts. Considering both sexes, adult literacy in 1991 and 2005 was 31.1 and 48.8 percent respectively as presented in Table 5.9. The adult literacy rates for males were higher than that of female rates for both years. The literacy rates for both sexes, male and female increased annually by an average of 3.30, 2.27, and 5.37 percent respectively between 1991 and 2005. The increase in the adult literacy rate over that period was high and females in particular experienced the highest rate of increase in literacy because of the introduction of the female secondary education programmes by the government in the early 1990s (Alam *et al.*, 2009; Blunch and Das, 2007; Hove, 2007).

Table 5.9: Adult literacy rate (15 years and over) in rural area by gender *(in percent)*

Gender	1991*	1995**	2000**	2005**	2010***	Average change per year (%)[a]
Both Sex	30.1	42.9	48.7	48.8	50.0	3.30
Male	38.7	52.0	57.1	53.6	56.3	2.27
Female	21.5	33.6	38.6	43.8	44.6	5.37

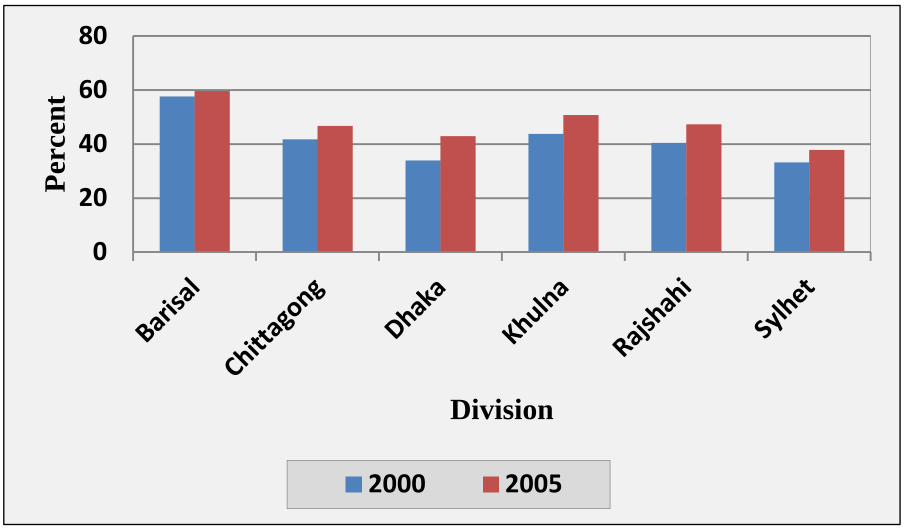
Note: [a] Changes shown between years 1991-86 and 2010

Source: *Compiled from Table 12.41, Statistical Yearbook of Bangladesh 2005, BBS; **Compiled from Table 12.41, Statistical Yearbook of Bangladesh 2008, BBS; ***Author's calculation based on data from HHS-2010 conducted by the author; [a] author's calculation

5.5.3 Literacy by Regional Distribution

According to the Bangladesh Bureau of Statistics (BBS, 2007b), there was considerable variation in the rural literacy rate over the six administrative divisions (regions) in Bangladesh. Amongst the six divisions, Barisal experienced the highest rate of literacy for both years – 2000 and 2005, followed by Khulna. On the other hand, Sylhet experienced the lowest rate of literacy followed by Dhaka for the same years. Rajshahi and Chittagong experienced very similar rates of literacy over the same period as shown in Figure 5.8.

Figure 5.8: Rural literacy rate by administrative division in 2000 and 2005



Source: Author's graph based on data from BBS Table 7.1 of HHIE Survey 2005, and Table E-01 of HHIES 2000

5.6 Household Income and Consumption

This section analyses income and consumption expenditure of rural households in Bangladesh. It illustrates the descriptive statistics of household income and consumption separately.

5.6.1 Household Income

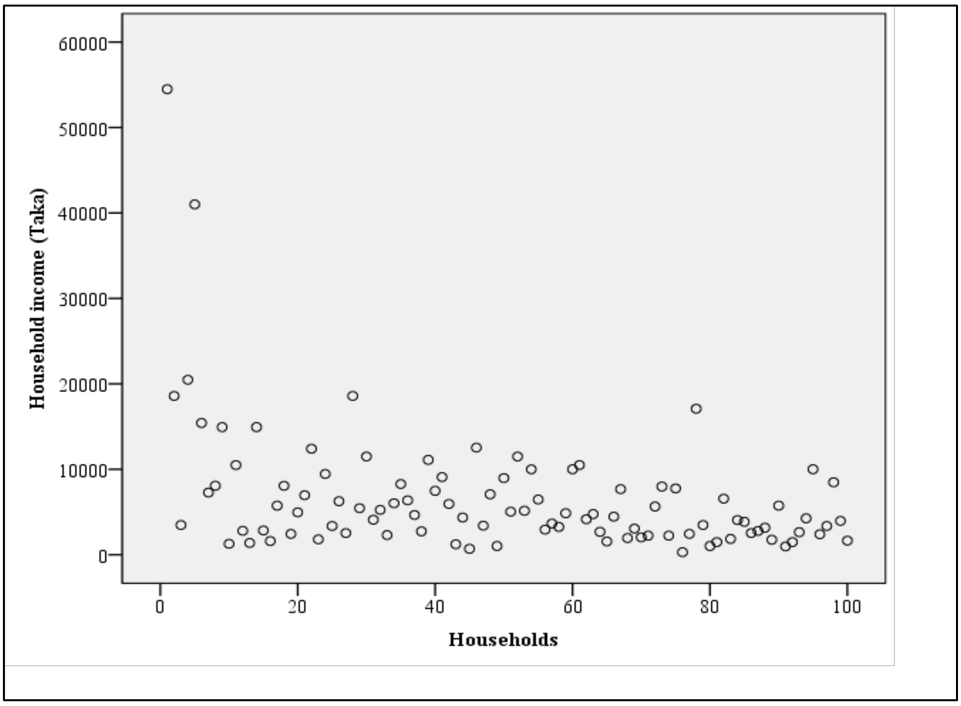
Table 5.10 presents the descriptive statistics of income of the rural households. In 1985-86, the average (mean) household income was 2168.61 taka (Bangladesh currency – US$1 = 69 taka at 2010 exchange rate). The mean household income increased gradually as the economy grew. In 2010, the mean household income increased to 8151.59. Figures 5.9 and 5.10 showed the extreme values of income distribution in 2005 and 2010 respectively. The standard deviations for all years were very high suggesting that the dispersion of data from the mean was large. The positive skewness for all years suggests that the distribution of household income was right-skewed or a large proportion of data were distributed on the left side of the mean. It also indicates that the extreme values of income distribution were situated to the right side of the mean implying that the mean is larger than the median and the median is larger than the mode of household income. Similarly, the kurtosis for all years was positive indicating that the distribution of household income was peaked. The standard deviation, skewness, and kurtosis suggest that the distribution of household income was neither normal nor symmetric during 1985-86 to 2010, indicating inequality in income distribution – few households received a large share of income.

Table 5.10: Rural household characteristics by monthly income *(in Taka)***

Statistical measures	1985-86	1995-96	2005	2010*
Mean	2168.61	3987.67	6045.61	8151.59
Std. Deviation	359.93	284.00	123.23	286.06
Skewness	3.63	5.98	6.31	7.30
Kurtosis	3.33	4.01	4.42	4.70

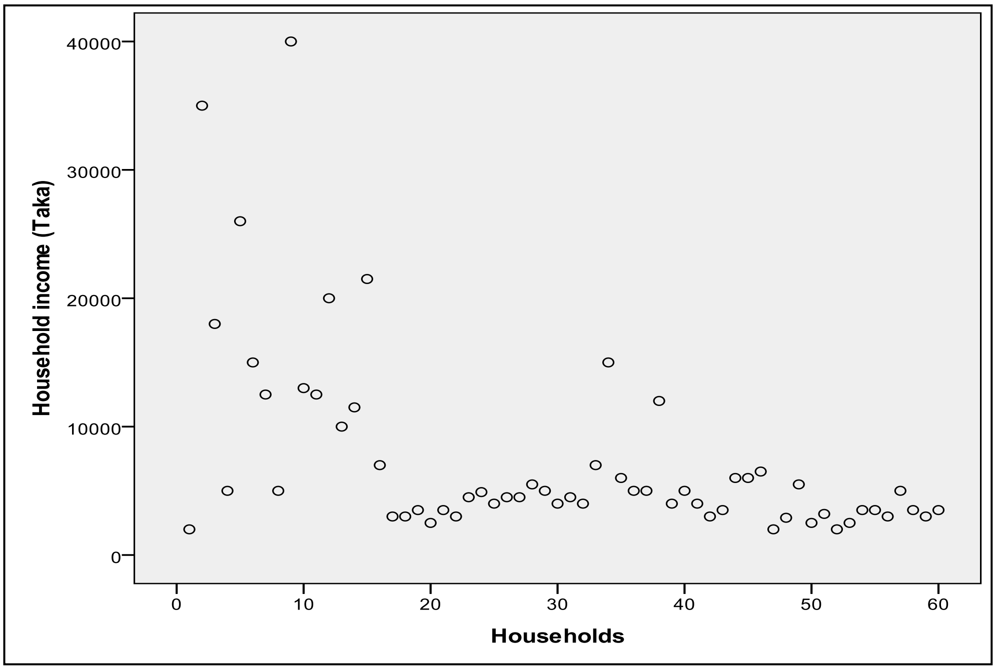
Note: ** Bangladesh's currency (US$1 = 69 Taka at 2010 exchange rate)
Source: Author's calculation from BBS HHIES 2005, HHES 195-96 and HHES 1985-86, and * HHS-2010 conducted by the author

Figure 5.9: Distribution of household monthly income (Taka) in 2005



Source: Author's calculation from HHIES-2005

Figure 5.10: Distribution of household monthly income (Taka) in 2010



Source: Author's calculation from HHS-2010 conducted by the author

5.6.2 Household Consumption

Table 5.11 shows the characteristics of rural household monthly consumption expenditure. In 1985-86, the mean household consumption was 2066.18 taka and that increased to 5827.97 taka in 2010. Like income, household consumption expenditure also increased gradually in the period 1985-86 to 2010. However, the standard deviations for all years were very large suggesting that the data were spread out over a large range of values. The skewness for all years was positive implying that the distribution of household consumption was right skewed and the household mean consumption was greater than the median and the median was greater than the mode. The kurtosis for all years was also positive indicating a peaked distribution of household consumption. Like household income, the distribution of household consumption was neither normal nor symmetric for all years during 1985-86 to 2010, suggesting inequality in distribution of consumption across rural households – few households had large consumption expenditure.

Table 5.11: Rural household characteristics by monthly consumption

(*in Taka*)

Statistical measures	1985-86	1995-96	2005	2010*
Mean	2168.18	3704.79	5538.14	5827.97
Std. Deviation	498.52	732.00	898.82	603.22
Skewness	3.51	4.62	3.84	4.86
Kurtosis	4.29	5.95	3.72	4.46

Source: Author's calculation from BBS HHIES 2005, HHES 195-96 and HHES 1985-86, and * HHS-2010 conducted by the author

Households use their income for consumption and savings. In 1985-86, the mean household income and consumption were the same, while the mean income became gradually greater than the mean consumption in 1995-96, 2005, and 2010, suggesting that households gradually saved a larger share of their income. These savings might have come from those households that had large income.

5.7 Characteristics of Rice Cultivation

This section analyses the characteristics of rice cultivation in Bangladesh. It includes types of rice crops, land use in rice cultivation, stages of rice production, input use, cost of rice production and average yield.

5.7.1 Rice Crops and Varieties

5.7.1.1 Three Rice Crops: Aus, Amon and Boro

Bangladesh farmers produce three main rice crops per year: Aus, Amon, and Boro. There are six natural seasons in a year in Bangladesh: summer (mid-April to mid-June), rainy season (monsoon) (mid-June to mid-August), pre-autumn (mid-August to mid-October), autumn (mid-October to mid-December), winter (mid-December to mid-February) and spring (mid-February to mid-April).

Out of the six seasons, summer, monsoon, and winter have significant impact on rice cultivation. Farmers cultivate Aus, Amon, and Boro during the summer, monsoon, and winter seasons respectively. The summer is dry with hot temperatures ranging from 30-41C degrees (BBS, 2007b, 2008). During summer, the availability of water for irrigation is very low, thereby limiting rice cultivation to selected land only. The monsoon accounts for more than 80 percent of the total rainfall (BBS, 2007b). During this season, rainwater keeps low agricultural land submerged. Farmers cultivate rice on high land. The winter is a good season for rice cultivation due to the availability of surface and ground water for irrigation.

Amongst the three rice crops, Aus is the first crop of the year. The farmers plant Aus during late spring and early summer (March-April) and harvest during late summer and the early rainy season (June-July). As revealed in HHS-2010, farmers cultivated less Aus crop in recent years because Aus is less productive than the other two rice crops due to hot weather and low availability of water for irrigation.

Amon is the second rice crop of the year. The farmers usually plant Amon during early rainy season (June-July) prior to the beginning of monsoon rain and harvest in the early autumn (October-November). Amongst the three rice crops, Amon covers the largest proportion of cultivable land for rice production. Amon is sub-divided into two categories: T-Amon (transplanted) and B-Amon (sown). Farmers cannot apply the new technology – a combination of irrigation-fertiliser-HYV seed – to B-Amon rice because B-amon is cultivated in the low land which remains submerged during the monsoon and rainy seasons, suggesting that agricultural trade liberalisation could not influence the production of B-Amon.

Boro is the third rice crop of the year. The farmers plant Boro in early winter (November-December) and harvest the crop in the early summer (April-May). Amongst the three rice crops, Boro captured the largest share of rice production with the highest productivity.

5.7.1.2 Rice Varieties

Each rice crop consists of two varieties: local varieties and high yielding varieties (HYV). Farmers cultivate a mix of two rice varieties for all three crops. Local varieties of rice are those which farmers have traditionally grown. High yielding varieties of rice are those which are developed (through research) by research institutes such as Bangladesh Rice Research Institute (BRRI) and International Rice Research Institute (IRRI).

5.7.2 Characteristics of Land Used for Rice Cultivation

Table 5.12 presents the descriptive statistics of land used for rice cultivation and other farming activities. As revealed in the HHS-2010, farmers use their land for a combination of three rice crops (Aus, Amon, and Boro) and other farming activities such as horticulture. The average (mean) area of land used for rice cultivation was 1.772 acres and for other farming activities was 0.176 acres in 2010. The mean for Aus, Amon and Boro crops combined (three crops over the same land in the year) was 0.431 acres. Two rice crop combinations, Amon and Boro, captured the largest share of cultivable land with a mean of 1.109 acres in 2010. Considering single rice crops, the mean value of land used for Aus, Amon, and Boro was 0.000, 0.102, and 0.077 acres respectively in 2010. The values of standard deviation were small for all cases of rice cultivation and other farming activities, indicating that the data points tended to be very close to the mean and the variation or dispersion of data from the mean was small. The positive skewness indicates that data were right-skewed and the largest skewness was associated with Aus and Boro cultivation. The positive kurtosis suggests that data were peaked and the highest peak was associated with Aus and Boro production. These facts suggest that the distribution of land for different rice cultivation was neither normal and nor symmetric.

Table 5.12: Land use for rice cultivation and other farming activities: 2010 *(in acres)*

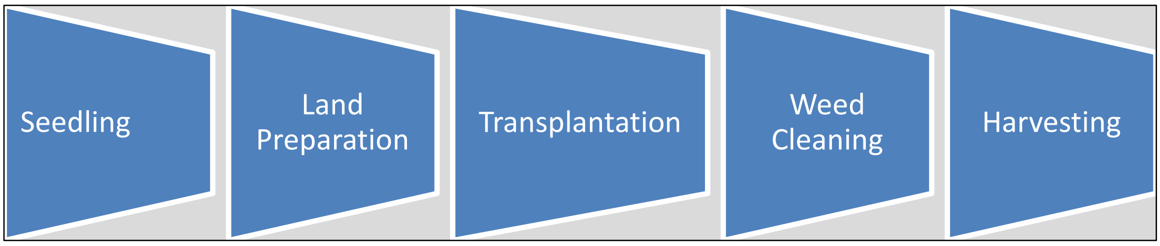
	Mean	Standard Deviation	Skewness	Kurtosis
Rice cultivation	1.772	1.828	2.588	8.007
Aus, Amon and Boro	0.431	0.692	1.765	2.105
Aus and Amon	0.065	0.2374	3.630	12.345
Aus and Boro	0.039	0.179	4.850	24.24
Amon and Boro	1.109	1.028	2.178	5.719
Aus	0.000	0.000	0.000	0.000
Amon	0.102	0.2823	3.743	16.334
Boro	0.077	0.252	3.294	9.675
Other farming activities	0.176	0.234	1.573	2.563

Source: Author's calculation from HHS-2010 conducted by the author

5.7.3 Stages of Rice Production

Rice cultivation goes through five main stages as shown in Figure 5.11.

Figure 5.11: Stages of rice cultivation in Bangladesh: 2010



Source: Author's drawing based on information from HHS-2010 conducted by the author

5.7.3.1 Stage One: Seedling

Farmers firstly grow seedlings in the most suitable piece of land on which they can easily control irrigation and water flows for the protection and smooth growth of seedlings. Seedlings are usually ready for transplantation after 20 days. Farmers apply fertilisers and pesticides to promote healthy growth of seedlings.

5.7.3.2 Stage Two: Land Preparation

Land preparation involves ploughing the land to get it ready for transplantation of the rice seedlings. Farmers prepared 95 percent of the land with powered-tillers – small machines for ploughing – in 2010. The remaining 5 percent was ploughed with bullock or spade. They use a spade in that land which has a soft base and is unsuitable for the use of either powered-tiller or bullock. They usually plough four times over the same piece of land with 2 to 4 days intervals to make it ready for transplantation. They use fertilisers to increase fertility of the land at the final stage of land preparation. They use irrigation to prepare the land effectively.

5.7.3.3 Stage Three: Transplantation

All farmers carry out transplantation manually. Farmers complete transplantation when seedlings are between 20 to 35 days old. They carefully uproot rice plants from seedling areas and place them on the prepared land. They maintain a low level of water for transplanted rice plants so that plants can survive and gradually grow new roots. There are usually 2 to 4 plants per stand, keeping a distance between two stands from 17 to 25 centimetres depending on soil fertility and rice varieties.

5.7.3.4 Stage Four: Weed Cleaning

All farmers clean weeds manually using sickles. Weed cleaning starts between two to three weeks after transplantation and is repeated two or three times, depending on density and growth of weeds.

5.7.3.5 Stage Five: Harvesting

Harvesting is the last stage of rice cultivation. Farmers harvest the paddy manually using sickles. They reap the grain and leave it in the field for one or two days to dry, before carrying it home.

5.7.4 Person-days Required for Rice Cultivation

Table 5.13 presents the distribution of average person-days required for the different stages of rice production per acre in 2010. Land preparation, plantation, and harvesting were the most labour-intensive activities in rice cultivation. The values of standard deviation, skewness, and kurtosis were low, suggesting that data were fairly distributed around the mean except for land preparation which had relatively large values of these three measures.

Table 5.13: Characteristics of rice cultivation by average person-days required for different activities of rice production per acre: 2010

Activities in rice production	Mean	Standard Deviation	Skewness	Kurtosis
Land preparation	13.052	3.867	2.648	7.055
Rice plantation	13.513	1.4069	0.794	0.707
Weed cleaning	6.315	0.940	0.466	0.332
Harvesting	12.986	1.227	0.090	1.424

Source: Author's calculation from HHS-2010 conducted by the author

5.7.5 Cost of Rice Cultivation

The cost of labour varies considerably for the different stages of rice cultivation. Land preparation is the most expensive activity in rice cultivation because most farmers use powered tillers, which involves hiring a machine (powered tiller) and an operator. The mean values for other activities were very similar. The standard deviations for all activities were very large, suggesting large variations of observations from the mean. The skewness for land preparation was negative indicating that the mean was smaller than the median. The kurtosis for land preparation was very large and positive, indicating a high peaked distribution of data. The skewness for all other activities was considerably small, suggesting a symmetric distribution of data for these activities.

Table 5.14: Characteristics of rice cultivation by average cost of different activities of rice production per day labour hire: 2010 ***(in taka –*** currency in Bangladesh***)***

Activities in rice production	Mean	Standard Deviation	Skewness	Kurtosis
Land preparation	331.052	43.60	-3.492	15.054
Rice plantation	149.342	15.560	0.958	1.097
Weed cleaning	129.605	13.822	0.848	0.785
Harvesting	152.631	10.573	1.301	3.241

Source: Author's calculation from HHS-2010 conducted by the author

Inputs for rice production include seeds, irrigation, fertilisers, and pesticides. The mean values of rice seeds for Aus, Amon and Boro crops were very similar, around 1050 taka per acre, but the values of standard deviations were very large for all three crops. Similarly, the corresponding mean values of fertilisers and pesticides were very similar across the three crops. There was a strong variation in the mean values of irrigation across the three crops.

Table 5.15: Average cost of different inputs of rice production per acre: 2010 (in taka)

Activities in rice production		Mean	Standard Deviation	Skewness	Kurtosis
Rice seeds	Aus	1071.052	111.227	-0.130	-0.050
	Amon	1044.736	194.098	-3.181	14.822
	Boro	1069.736	111.221	-0.094	-1.387
Irrigation	Aus	1326.315	691.5255	0.657	-0.057
	Amon	1478.947	640.0624	0.354	-0.055
	Boro	3128.947	441.684	-.385	-0.301
Fertilisers	Aus	3034.210	520.018	-0.149	-0.484
	Amon	3035.526	517.910	-0.138	-.484
	Boro	3053.947	521.741	-0.225	-0.520
Pesticides	Aus	1371.052	379.834	0.029	-1.321
	Amon	1375.000	386.031	0.016	-1.402
	Boro	1372.368	388.291	0.022	-1.425

Source: Author's calculation from HHS-2010 conducted by the author

6.7.6 Average Yields

The lowest value of the mean (average yield) was 1.574 tonnes during 1986-90 and the highest value was 2.402 tonnes during 2001-05. The values of standard deviation, skewness, and kurtosis were considerably low for all years suggesting that the average yield of rice per acre was very close to a normal and symmetric distribution. This analysis suggests that the observations were fairly distributed around the mean.

Table 5.16: Characteristics of rice production by average yield per hectare (in tonne)

Year/period	Mean	Standard Deviation	Skewness	Kurtosis
1986-90	1.574	0.122	0.425	-3.015
1990-95	1.776	0.045	-1.493	2.818
1996-00	2.028	0.204	0.739	-1.159
2001-05	2.402	0.093	-0.148	-1.001
2010*	2.070	0.791	0.719	0.429

Source: Author's calculation from Table 3.01 (MoA, 2007); * HHS-2010 conducted by the author

5.8 Household Involvement with the Rice Market

All rural households are involved directly with the rich market as buyers, as sellers, or as both because rice is their staple food.

5.8.1 Rice Production, Selling and Buying

In 2010, 68.3 percent of rural households were rice producers and 31.7 percent were non-producers, 66.7 percent were sellers and 33.3 percent were non-sellers, 68.6 percent were buyers and the rest 31.4 percent were non-buyers.

Table 5.17: Rural household involvement in rice production, selling and buying: 2010

		Percent
Production	Producer	68.3
	Non-producer	31.7
Selling	Seller	66.7
	Non-seller	33.3
Buying	Buyer	68.4
	Non-buyer	31.6

Source: Author's calculation from HHS-2010 conducted by the author

5.8.2 Household Behaviours: Rice Selling and Buying

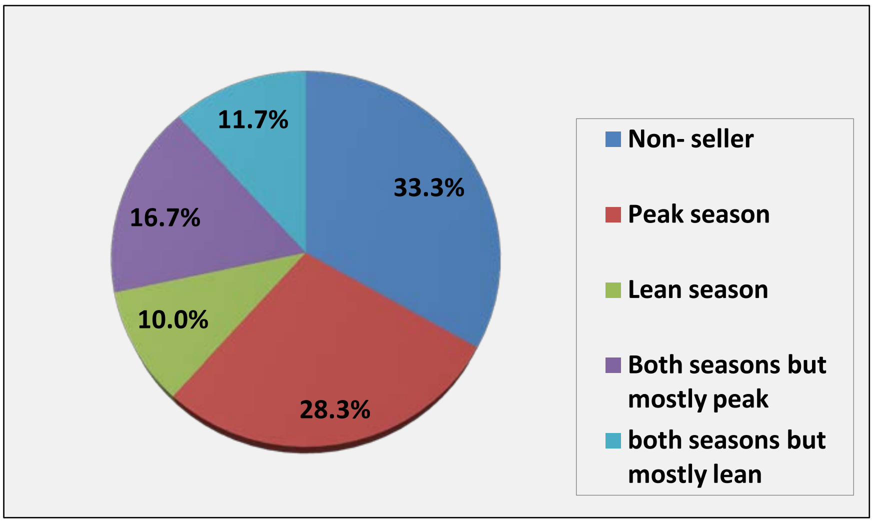
In 2010, 28.3 percent of rural households sold rice in the peak season during harvesting, and 10 percent sold rice during the lean season, and 16.7 percent sold rice during both seasons but mostly during the peak season. Similarly, 11.7 percent sold rice during both seasons but mostly during the lean season. In that year, 33.3 percent of households were not involved in selling rice at all. The non-sellers were mainly poor households such as agricultural labourers and the peak season sellers were mainly small farmers who sold rice immediately after harvesting to repay loans and meet household expenditure. Conversely, the lean season sellers were mainly large and medium farmers.

Table 5.18: Household rice selling behaviours by household types: 2010

Household type	Percent of households				
	Non-seller	Peak season	Lean season	Both seasons but mostly peak	Both seasons but mostly lean
All rural households	33.33	28.33	10.00	16.67	11.67
Farm households	26.92	32.69	7.69	19.23	13.46
Non-farm households	75.00	0.00	25.00	0.00	0.00
Large farmers	0.00	0.00	100.00	0.00	0.00
Medium farmers	0.00	0.00	14.29	0.00	85.71
Small farmers	0.00	56.67	6.67	33.33	3.33
Agricultural labourers	100.00	0.00	0.00	0.00	0.00

Source: Author's calculation from HHS-2010 conducted by the author

Figure 5.12: Rural household rice selling behaviours: 2010



Source: Author's calculation from HHS-2010 conducted by the author

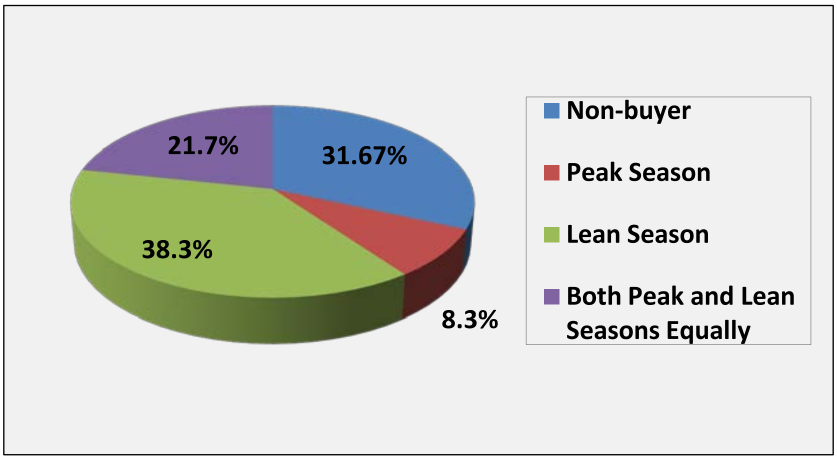
In 2010, 31.67 percent of rural households were non-buyers, 8.33 percent bought rice during the peak season, 38.33 percent bought during the lean season, and 21.67 percent bought during both peak and lean seasons. Non-buyers consisted of large and medium farmers and also some non-farm households who produced rice but their main income came from non-farm activities. The peak season buyers were mainly rich non-farm households who procured rice at the lowest price of the year during the peak season. The lean season buyers were mainly small farmers who sold rice during the peak season immediately after harvesting but had to buy rice during the lean season to feed their families. Agricultural and non-farm labourers were the main buyers during both peak and lean seasons because they were not producers. However, they did not have the resources to buy large quantities of rice to keep in reserve for the lean season because of a combination of limited income and lack of storage facilities.

Table 5.19: Household rice buying behaviours by household types: 2010

Household type	Percent of households			
	Non- buyer	Peak season	Lean season	Both seasons equally
All rural households	31.67	8.33	38.33	21.67
Farm households	34.62	1.92	38.46	25.00
Non-farm households	12.50	50.00	31.50	6.00
Large farmers	100.00	0.00	0.00	0.00
Medium farmers	100.00	0.00	0.00	0.00
Small farmers	33.33	0.00	66.67	0.00
Agricultural labourers	0.00	7.14	0.00	92.86

Source: Author's calculation from HHS-2010 conducted by the author

Figure 5.13 : Household characteristics of rice buying: 2010



Source: Author's calculation from HHS-2010 conducted by the author

5.8.3 Household Characteristics by Net Sellers and Net Buyers

An important characteristic of Bangladesh's agriculture is that the majority of farm households are small subsistence farmers. Thus, most farm households are both producers and consumers simultaneously, although they may be either net buyers or net sellers of rice at different times of a year. Net buyers also included agricultural labourers and non-farm workers. Although net buyers are predominantly poor households, rich non-farm households such as input dealers and businesspersons who do not produce rice are also net buyers. On the contrary, large and medium farmers and some small farmers are net sellers.

The distribution of rural households by involvement in the rice market is shown in Table 5.20. The ratios of net sellers gradually increased between 1985-86 and 2010 thereby the ratios of net buyers gradually decreased over the same period. This indicates that a large number of small farmers became net sellers in the post-liberalisation period, suggesting that agricultural trade liberalisation might have increased the productivity of rice in the post-liberalisation period.

Table 5.20: Distribution of rural households by net sellers and net buyers

(in percent)

HH type	1985-86	1995-96	2005	2010*
Net seller	36.0	43.4	64.1	66.7
Net buyer	64.0	56.6	35.9	33.3

Source: Author's calculation from various household surveys of BBS, *HHS-2010 conducted by the author

5.8.4 Characteristics of the Rural Rice Market

5.8.4.1 Seasonal Variation in Rice Price

The price of rice is determined mostly by domestic factors rather than by international price fluctuations because rice is a non-exported good in Bangladesh. There are strong seasonal variations in rice prices in the rural markets. The seasonal variations can be attributed to local seasonal demand and supply responses. During the peak season the demand for rice decreases drastically because all farmers consume their own rice, but the supply of rice increases significantly because all farmers (including small farmers, some of whom are predominantly net buyers) sell rice for meeting their usual household expenditure and loan repayments. These demand and supply responses jointly push rice prices down to achieve equilibrium in the local rice market. During the lean (off-peak) season, the scenario is reversed – the majority of the rural households, including some small farmers, become buyers, thereby pushing up the demand for rice. Therefore, in a market mechanism, the price of rice increases during the lean season to attain equilibrium between demand and supply.

5.8.4.2 Rice Syndicates

The study explored an existence of imperfection in the rice market in the form of rice syndicates. Rice syndicates work as intermediaries in the rice market between producer and consumers.

Most rural household respondents expressed the opinion that rice syndicates dominated the rice market in rural areas. These rice syndicates were the groups of predominantly urban rice traders and merchants who worked in association with rural elites such as the managers of rural rice markets, political leaders, and local rice traders. They benefited most from seasonal rice price changes, buying at lower price during the peak season, and selling at a much higher price during the lean season. They controlled the rice market and gained largely by exploiting both producers and consumers.

5.9 Conclusion

From the above analyses, the majority of rural households were farm households. Most households were male-headed. The literacy rate of the head of households as well as the general adult literacy rate was low. Farmers produced three rice crops in a year. The average production cost of rice per acre in terms of input use varied across the three rice crops as well as across the various stages of rice cultivation. All rural households were involved with rice market as sellers or buyers or both.

Although this chapter discussed the characteristics of rural households and rice cultivation, it did not attempt to analyse how trade liberalisation affected rice production. The following chapter, Chapter 6, analyses the impact of agricultural trade liberalisation on rice production, productivity-growth, and household welfare.

CHAPTER SIX

Agricultural Trade Liberalisation: Technological Transformation, Changes in Productivity of Rice and Household Welfare

6.1 Introduction

The preceding chapter discussed characteristics of households and rice cultivation, however, it did not attempt to analyse how agricultural trade liberalisation influenced rice production, productivity-growth and reallocation of resources.

The aim of this chapter is to analyse the changes in household welfare as a result of changes in productivity of rice due to technological transformation resulting from agricultural trade liberalisation. This chapter examines the technological transformation in rice production through analysis of the changes in use of factors of production such as irrigation, fertilisers, pesticides, and high yielding varieties (HYV) seeds. It also analyses the changes in cropping patterns of rice cultivation due to technological transformation resulting from agricultural trade liberalisation.

It analyses total factor productivity (TFP)-growth of rice and growth of factors of production; how productivity has changed and how these changes affected rice production and the welfare of rural households. Using OLS regression analyses, this chapter critically examines the determinant factors of rice output.

6.2 Technological Transformation

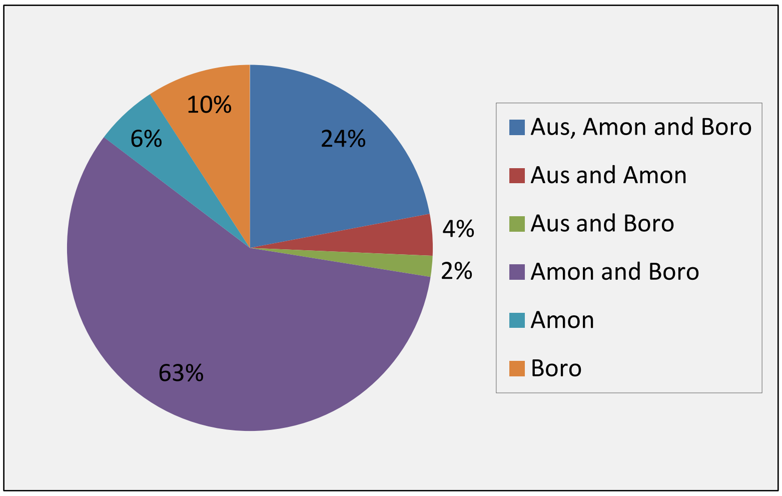
Import liberalisation of agricultural inputs (such as irrigation equipment, fertilisers, and pesticides) and an increase in the use of HYV seeds influenced technological transformation in rice production. Here technological transformation refers to shifting rice production technology from traditional to modern or semi-modern status. Bangladesh's agriculture has experienced technological transformation in rice production since the late 1980s. This new and improved technology is a combination of irrigation, fertilisers, and HYV seeds. This section analyses how technological transformation influenced the patterns of use of factors of rice production such as land, labour, capital and other inputs in the post-liberalisation era.

6.2.1 Changes in the Use of Factors of Rice Production

Land, irrigation, fertilisers, pesticides and HYV seeds are the fundamental factors and inputs of rice production in Bangladesh. As discussed in Chapter 5, farmers can produce three rice crops (Aus, Amon, and Boro) on the same land in different seasons of the year. However, not all plots of cultivable land are suitable for production of all three rice crops because of agro-ecological reasons such as some land remaining submerged during the rainy season (June-July). Thus, some land is suitable for three crops, some is suitable for two crops, and some is suitable for only one crop in the same year.

Approximately 94 percent of the total cultivable land is used for rice production. Out of the three major rice crops, Amon and Boro jointly captured the largest share of land, 63 percent of the total land for rice production in 2010 as shown in Figure 6.1. Aus, Amon and Boro rice crops jointly covered 24 percent of the total land for rice cultivation. As a single crop, Boro captured the highest share – 10 percent of the total land for rice cultivation, whereas the individual share for Aus and Amon was insignificant.

Figure 6.1: Share of land use for different rice cultivation: 2010

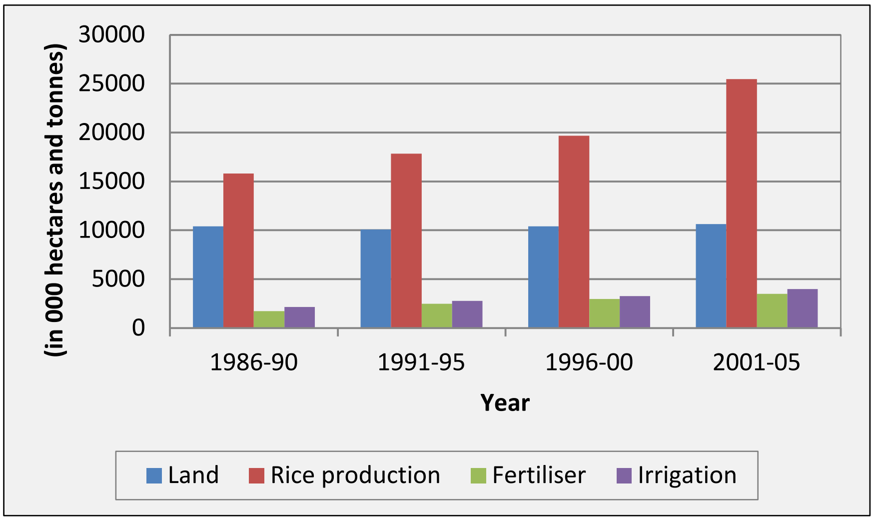


Source: Author's calculation from HHS-2010

The total amount of land used for rice cultivation remained constant at around 10.50 million hectares during 1986-2005 (Figure 6.2), indicating that Bangladesh has exhausted its land available for rice production. Cropping intensity has increased with higher use of improved technology such as irrigation, fertilisers, pesticides, and HYV seeds, resulting in a higher volume of rice production.

The HHS-2010 revealed that all three major rice crops (Aus, Amon, and Boro) required almost the same amount of seeds, fertilisers, and pesticides with the main variation being the use of irrigation across three crops. Boro cultivation attracted the highest irrigation costs because it is a dry-season crop. Aus and Amon are produced during the wet seasons when there is less need for irrigation.

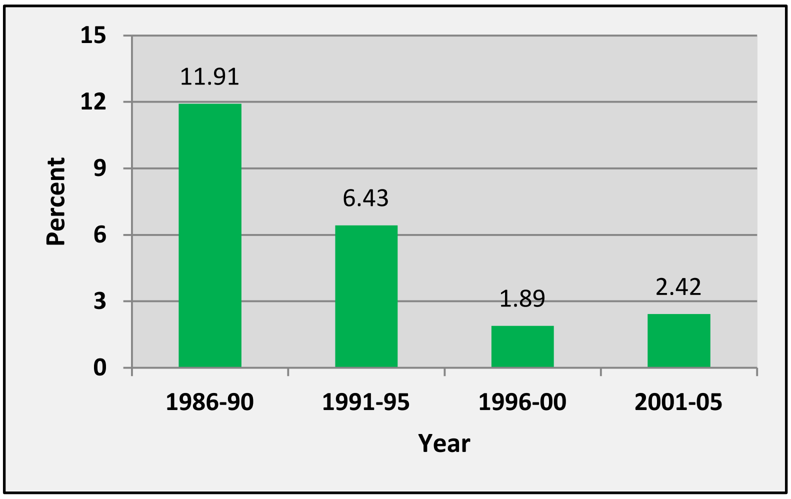
Figure 6.2: Land (hectares), rice production (tonnes), fertiliser (tonnes), and irrigation (hectares): 1986-90 to 2001-05



Source: Author's calculation from Table 1.03, 2.01, 4.01 and 5.05 (Ministry of Agriculture, 2007)

Agricultural trade liberalisation opened the irrigation and fertiliser markets. Wider applications of fertilisers, facilitation of irrigation and the increased adoption of HYV seeds have improved rice production technology, leading to a substantial growth in rice output. The demand for chemical fertilisers increased significantly immediately after liberalisation during 1986-90 because of the more intensive use of fertiliser in rice production and lower fertiliser prices in the post-liberalisation era (Figure 6.3). As revealed in the HHS-2010, 95 percent of respondents opined that the price of fertilisers decreased significantly after the 1990s. Farmers had greater access to cheaper fertilisers in the post-liberalisation period than in the pre-liberalisation era.

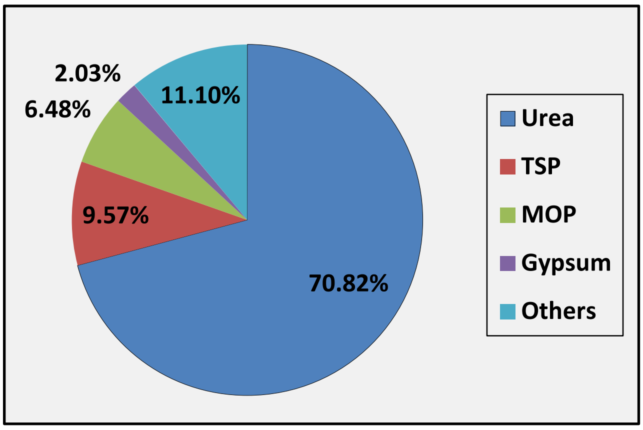
Figure 6.3: Average annual growth of fertiliser use: 1986-2005



Source: Author's calculation from Table 4.02 (Ministry of Agriculture, 2007)

The volume of fertiliser production and imports increased in the post-liberalisation period. According to the Ministry of Agriculture statistics, in 1989-90 the total supply of fertilisers was 1.99 million tonnes with the shares of domestic production and imports being 81.41 and 18.59 percent respectively. In 2006-07, this amount increased to 3.65 million tonnes and the share of domestic production and imports was 59.46 and 40.54 percent respectively. Urea, triple-super phosphate (TSP), muriate of potash (MOP) and gypsum are the major types of fertilisers used in rice production in Bangladesh. Amongst them, the demand for urea was the highest because of its credibility to rice farmers for higher productivity as revealed in the HHS-2010. In 2006-07, urea accounted for 70.82 percent compared to 29.18 percent of the other types of fertilisers (Figure 6.4).

Figure 6.4: Share of different fertilisers used in 2006-07

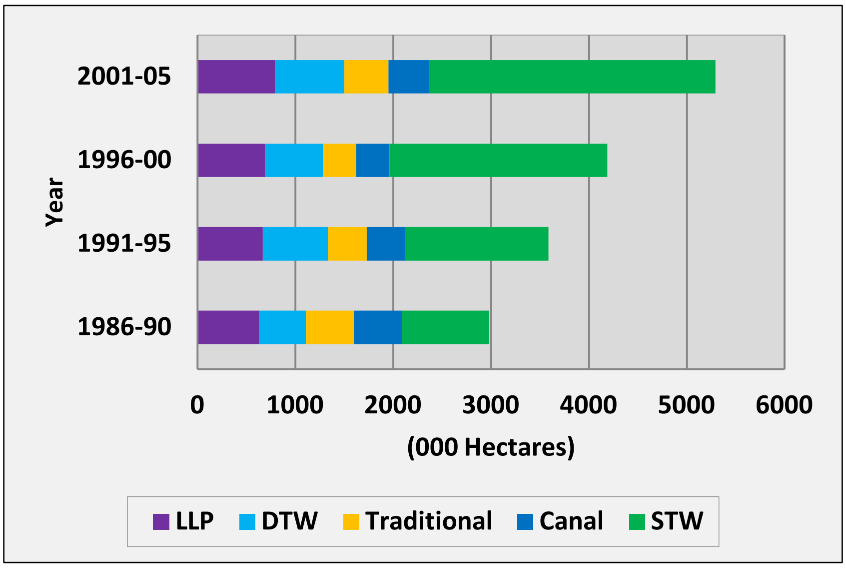


Source: Author's calculation from Table 4.03 (Ministry of Agriculture, 2007)

Similarly, the structure of irrigation changed in the post-liberalisation period as a result of agricultural trade liberalisation. Imported irrigation equipment replaced traditional irrigation methods. Farmers had greater access to imported irrigation equipment such as deep tube-well (DTW), low lift pump (LLP) and shallow tube-well (STW) technologies with lower prices than during the pre-liberalisation period. In HHS-2010, 90 percent of respondents expressed the opinion that there were significant decreases in the price of irrigation equipment during post-liberalisation era. Modern irrigation equipment replaced traditional irrigation systems such as canal, dam, and shifting water manually. The annual average area of irrigated land by canal and other traditional methods declined between 1986-90 and 2001-05 in the post-liberalisation era.

The average area irrigated by LLP and DTW steadily increased during the same period. The increase in average irrigated area under STW was the highest during that period. In 1986-90 the average area irrigated by STW was 0.892 million hectares and this figure increased to 2.925 million hectares in 2001-05 by a total increase of 227.91 percent with an annual average increase by 11.40 percent over the same period.

Figure 6.5: Average area under irrigation by method in Bangladesh

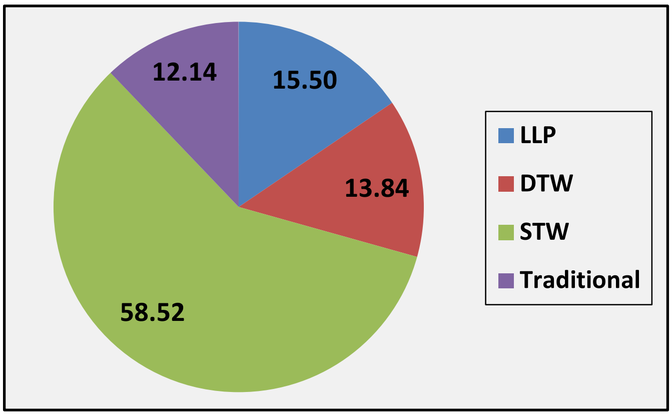


Source: Author's calculation from Table 5.06, (Ministry of Agriculture, 2007)

A large increase in the irrigated area under STW may be attributed to its characteristics such as low operational cost, cheap capital investment, and suitability for application to small- and medium-sized farms.

Thus, in 2005, 58.52 percent of the total irrigated land was by STW followed by LLP and DTW with 15.50 and 13.84 percent respectively. Despite technological change, traditional irrigation methods such as canal still had a significant share at 12.14 percent. This was because of their comparative advantage over modern irrigation methods due to abundance of family labour and low cost.

Figure 6.6: Percentage share of irrigated land by methods of irrigation: 2005

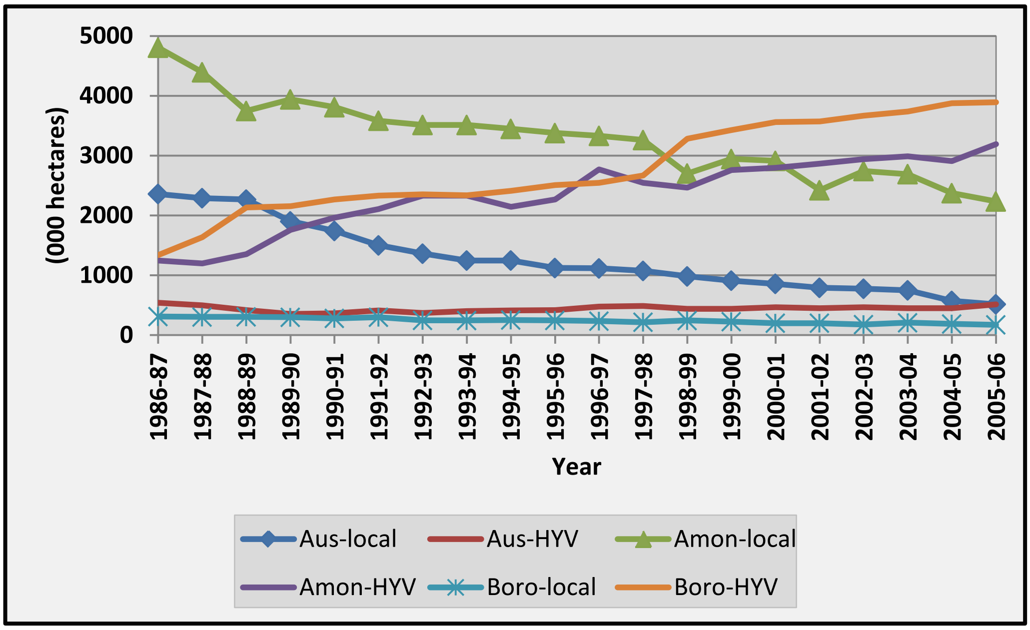


Source: Author's calculation from Table 5.06 (Ministry of Agriculture, 2007)

6.2.2 Changes in Cropping Patterns

The technological transformation in rice production influenced the cropping patterns of rice in Bangladesh. Figure 6.7 shows that the land was reallocated in favour of modern HYV rice from traditional local varieties through adoption of HYV rice for all three major crops during the period 1986-87 to 2005-06. This technological shift from local varieties to HYV rice indicates farmers' positive response towards adopting new and improved technology as well as modernisation of rice cultivation. Amongst the three HYV crops, Boro rice captured the largest area of land. There was a sharp decline in land used for Aus-local and Amon-local rice during 1986-87 to 2005-06. A very small proportion of land was used for Boro-local rice cultivation and that proportion remained almost the same all over this period. In 1986-87, Amon-local captured the largest area of land amongst all varieties of rice in Bangladesh. Although it released a large amount of land in favour of HYV rice production, it retained a significant amount of land in 2005-06. This is for agro-ecological reasons – some land areas are submerged with water during the rainy season and are suitable only for local rice cultivation as revealed in the HHS-2010.

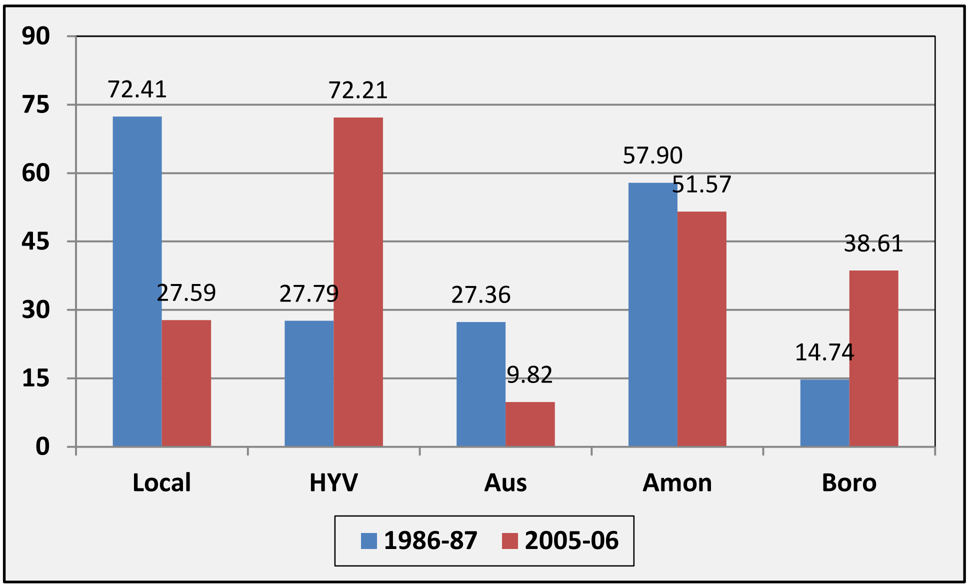
Figure 6.7: Changes in the pattern of land use for different rice crops



Source: Author's calculation from Table 2.01 (Ministry of Agriculture, 2007)

The changes in the proportional share of land by varieties of rice and crops are shown in Figure 6.8. In 1986-87, local varieties and HYV rice accounted for 72.41 and 27.59 percent of the total land for rice cultivation respectively. In 2005-06 the situation changed to the opposite – local varieties reduced to 27.79 percent and HYV increased to 72.21 percent of the total land for rice production. Similarly, the shares of land for Aus, Amon, and Boro changed during this period. The share of land for Amon decreased slightly from 57.90 percent in 1985-86 to 51.57 percent of the total rice cultivated land in 2005-06. The share of Aus decreased significantly from 27.36 to 9.82 percent over the same period. Thus, the share of Boro increased remarkably from 14.74 to 38.61 percent during that period. This is a clear indication that technological transformation facilitated farmers to shift from local varieties to HYV rice and from Aus to Boro crops during the post-liberalisation era.

Figure 6.8: Share of cultivated land by local and HYV rice: 1985-86 to 2005



Source: Author's calculation from Table 2.01 (Ministry of Agriculture, 2007)

The impact of the reallocation of land in favour of HYV and Boro cultivation was evident in their shares of rice production as shown in Table 6.1. The share of local varieties for all three crops in total rice production gradually declined during 1986-87 to 2005-07. The share of Aus crop production decreased and the share of Boro crop increased significantly over this period. Although the share of Amon crop dropped by a minimal proportion, it retained a considerable production of 40 percent in 2005-06. Therefore, there was a dynamic shift of cropping patterns from Aus to Boro crops and from local varieties to HYV rice in the post-liberalisation era. HYV Boro captured 52.4 percent of all rice production of which over 90 percent was HYV. Overall, the contribution of local varieties of rice became less significant in the post-liberalisation period (see Figure 6.9).

Table 6.1: Changes in share of rice production by varieties and crops

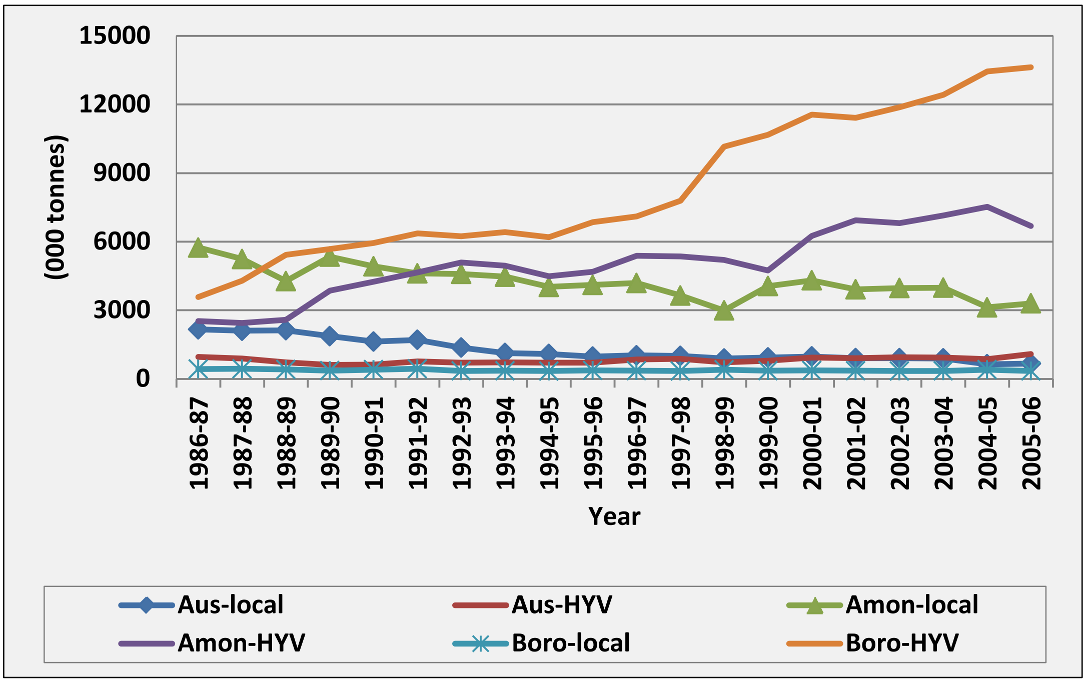
(in percent)

Year	Aus			Amon			Boro			All Rice
	Local	HYV	Total	Local	HYV	Total	Local	HYV	Total	
1986-87	14.00 *(69.31)*	6.20 *(30.69)*	**20.20** *(100)*	37.30 *(69.72)*	16.20 *(30.28)*	**53.50** ***(100)***	3.30 *(12.55)*	23.00 *(87.45)*	**26.30** *(100)*	**100**
1991-92	7.00 *(58.33)*	5.00 *(41.67)*	**12.00** *(100)*	25.00 *(49.02)*	26.00 *(50.98)*	**51.00** *(100)*	2.00 *(5.41)*	35.00 *(94.59)*	**37.00** *(100)*	**100**
1996-97	5.10 *(56.04)*	4.00 *(43.96)*	**9.10** *(100)*	22.10 *(43.94)*	28.20 *(56.06)*	**50.30** *(100)*	2.10 *(5.17)*	38.50 *(94.83)*	**40.60** *(100)*	**100**
2001-02	4.00 *(50.00)*	4.00 *(50.00)*	**8.00** *(100)*	16.00 *(36.36)*	28.00 *(63.64)*	**44.00** *(100)*	1.00 *(2.08)*	47.00 *(97.92)*	**48.00** *(100)*	**100**
2005-06	3.20 *(42.11)*	4.40 *(57.89)*	**7.60** *(100)*	12.00 *(30.00)*	28.00 *(70.00)*	**40.00** *(100)*	1.00 *(1.91)*	51.40 *(98.09)*	**52.40** *(100)*	**100**

Note: Figures in parentheses represent own percentage share of respective varieties and crop

Source: Author's calculation from Table 1.03 (Ministry of Agriculture, 2007)

Figure 6.9: Changes in the pattern of total rice production: 986-87 to 2005-06



Source: Author's calculation from Table 1.03 (Ministry of Agriculture, 2007)

Technological transformation in rice cultivation has positively affected rice production. Both total rice output and average yield per acre increased in the post-liberalisation era. These scenarios are analysed in the following sections.

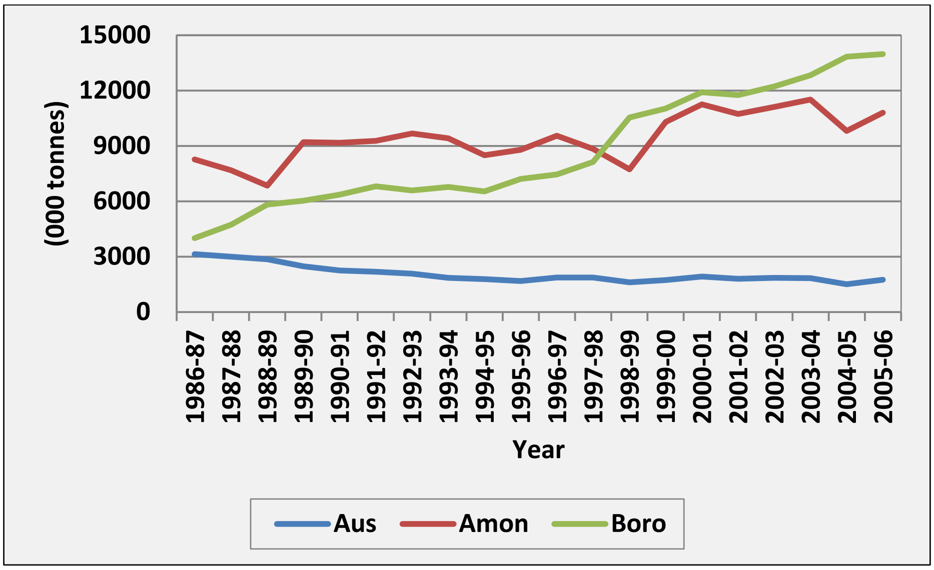
6.3 Changes in Rice Production

There was a significant change in the patterns of total rice production and average yields of rice as a result of technological transformation in the post-liberalisation period. Both total rice production and average yield increased significantly because of higher average yields of HYV rice than that of local varieties.

6.3.1 Total Rice Production

The dynamic shift in rice cultivation from local varieties to HYV rice contributed to higher volume of total rice production in the post-liberalisation era. According to the Ministry of Agriculture's statistics, the volume of total rice production rose from 15.41 million tonnes in 1986-87 to 26.53 million tonnes in 2005-06. This is an increase of 72.16 percent over the twenty-year period, an average of 3.61 percent per year. The total cultivated land for rice production remained almost constant over the same period. Therefore, it would be reasonable to attribute the increase in total rice production to improved technology. This technology consisted of a combination of irrigation, fertilisers and HYV seeds and a dynamic shift of rice cultivation from local varieties to HYV. HYV Boro gradually became the dominant rice crop in the post-liberalisation period overtaking Amon in about 1999-2000. Aus production decreased significantly, contributing only 7.6 percent in the same year.

Figure 6.10: Changes in patterns of total rice production by crops

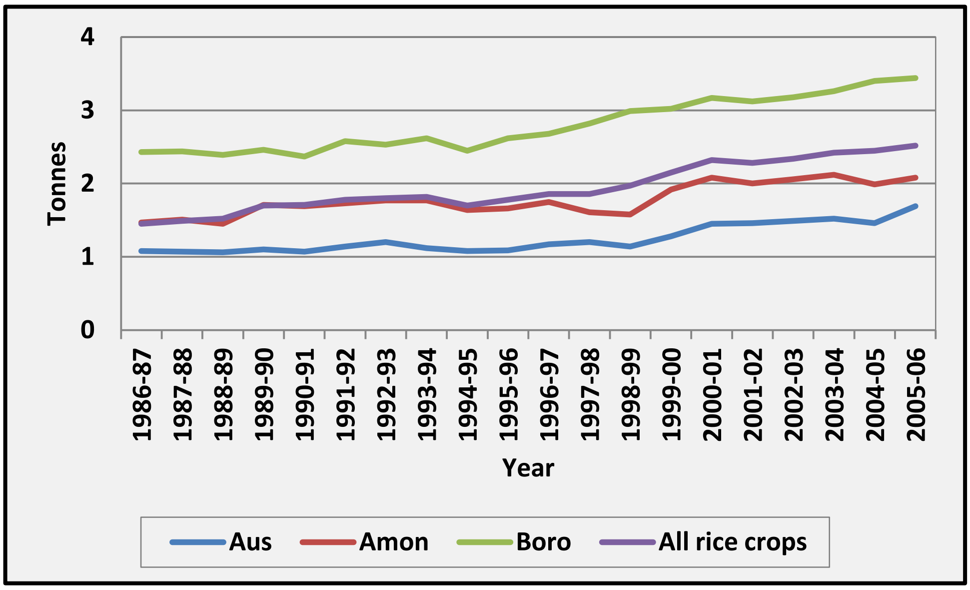


Source: Author's calculation from Table 1.03 (Ministry of Agriculture, 2007)

6.3.2 Patterns of Average Rice Production

All three crops – Aus, Amon and Boro – showed increased trend of average yield per hectare during 1986-87 to 2005-06 as shown in Figure 6.11. The average yield of Boro prevailed over other varieties. On the other hand, the average yield of Aus and Amon fell below the average yield of all rice. This reveals that Boro dominated not only the total rice production but also the average yield per hectare during the post-liberalisation period. Amongst the three crops, the average yield of Aus was the lowest as farmers gradually re-allocated land from Aus to Boro, for more efficient use of land as illustrated in Figure 6.8.

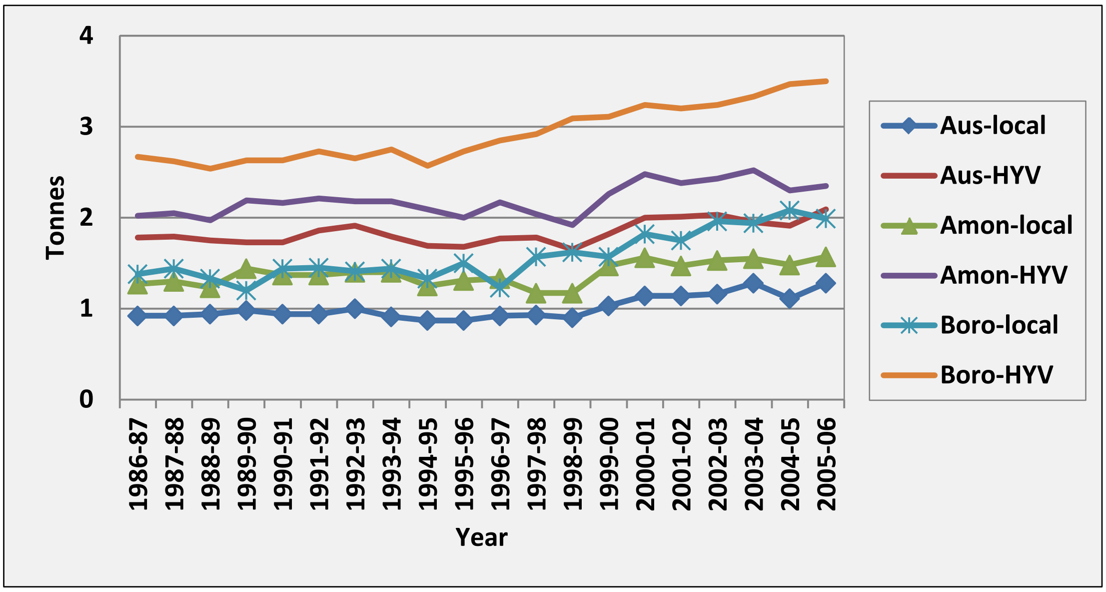
Figure 6.11: Trend of average rice yield per hectare by main crops



Source: Author's calculation from Table 3.01 (Ministry of Agriculture, 2007)

Considering the average yield of rice by varieties, HYV prevailed over local varieties as shown in Figure 6.12. This proposition is true for all three rice crops. Noticeably, the average yield of Boro-HYV rice per hectare was far above of the average yield of Aus-HYV and Amon-HYV. Similarly, the average yield of Boro-local per hectare was above the average yield of Aus-local and Amon-local varieties. This was despite only about 2 percent of total rice cropped land committed to local Boro. This could indicate more intensive use of irrigation for Boro crop than Aus and Amon.

Figure 6.12: Trend of average rice yield per hectare by varieties



Source: Author's calculation from Table 3.01 (Ministry of Agriculture, 2007)

6.4 Total Factor Productivity of Rice

Total factor productivity (TFP)-growth of rice measures the proportion of output, which is not explained by the amount of inputs used in rice production. Using the Data Envelopment Analysis (DEA) method, the Malmquist productivity index is calculated to analyse the TFP-growth of rice in Bangladesh. The DEA-based Malmquist productivity index measures the changes in TFP-growth over time. It is decomposed into two main components – technical efficiency change (TE) and technological change (TC). The TFP-growth index represents the multiplicative impacts of these two components. Technical efficiency measures farmers' ability to produce the maximum output (rice) possible from a given set of inputs and production technology. On the other hand, technological change measures the frontier shift – the shift in production possibility frontier (PPF). It represents technological progress (outward shift of PPF) or contraction (inward shift of PPF). Thus, a TFP-growth level is determined by how efficiently and intensely the inputs are utilised in rice production as well as by the level of technological change. If the value of TFP-growth is greater than one then it represents progress in productivity, implying an increasing return to scale and vice versa. Similarly, a unitary value of TFP-growth implies no change in productivity, indicating a constant return to scale in rice production.

Bangladesh experienced a positive change in the TFP-growth of rice immediately after agricultural trade liberalisation as shown in Table 6.2. TFP-growth increased from 1986-87 through to 1998-99 then declined gradually. The value of TFP was greater than one over the period 1990-91 to 1998-99 suggesting that the TFP-growth of rice improved during this period, indicating an increasing return to scale in rice production. On the other hand, the value of TFP-growth was less than one for the period 1999-2000 to 2005-06, implying that there was a decline in productivity of rice during that period and suggesting a decreasing return to scale in rice production. The frontier shift or TC showed a trend similar to changes in TFP-growth – it started to increase immediately after liberalisation and slowed down after 1998-99. The value of TC was greater than one during 1988-89 to 1997-98 suggesting that Bangladesh experienced technological progress in rice production during this period. However, during the other periods – 1986-87 to 1988-89 and 1999-2000 to 2005-06 – the value of TC was less than one, indicating that there was a technological contraction or non-improvement during that period. Noticeably, the value of TE was almost close to one over two decades from 1986-97 to 2005-06, implying that there was little change in technical efficiency over that period. Over twenty years from 1986-87 to 2005-06 the mean value of TFP was 1.0145 – greater than one, implying that Bangladesh experienced an average increase in the TFP-growth of rice during that period, indicating an increasing return to scale on average. Similarly, the mean value of TC was 1.0105 indicating that, on average, there was a technological progress, implying an outward shift of production possibility frontier during that period. The mean value of TE for that period was close to one (1.0005), suggesting that there was a positive-but-insignificant technical efficiency change over that period.

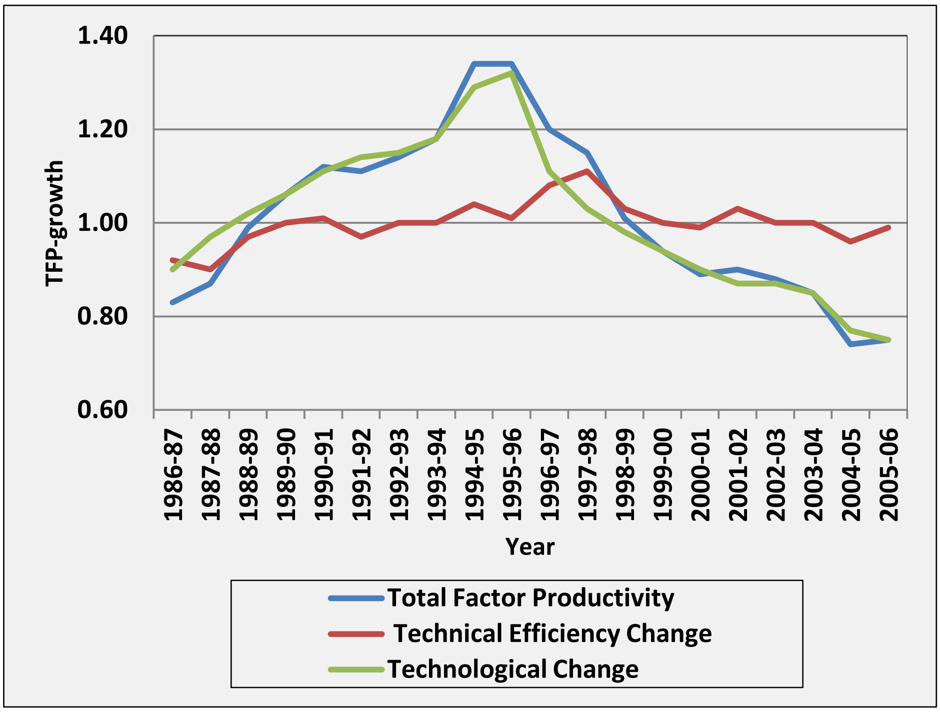
Table 6.2: Total factor productivity of rice in Bangladesh: 1986-87 to 2005-06

Year	*Malmquist Index (Total Factor Productivity)*	*Technical Efficiency Change*	*Frontier Shift (Technological change)*
1986-87	0.83	0.92	0.90
1987-88	0.87	0.90	0.97
1988-89	0.99	0.97	1.02
1989-90	1.06	1.00	1.06
1990-91	1.12	1.01	1.11
1991-92	1.11	0.97	1.14
1992-93	1.14	1.00	1.15
1993-94	1.18	1.00	1.18
1994-95	1.34	1.04	1.29
1995-96	1.34	1.01	1.32
1996-97	1.20	1.08	1.11
1997-98	1.15	1.11	1.03
1998-99	1.01	1.03	0.98
1999-00	0.94	1.00	0.94
2000-01	0.89	0.99	0.90
2001-02	0.90	1.03	0.87
2002-03	0.88	1.00	0.87
2003-04	0.85	1.00	0.85
2004-05	0.74	0.96	0.77
2005-06	0.75	0.99	0.75
Mean	**1.0145**	**1.0005**	**1.0105**

Source: Author's calculation using data from Table 1.03, 2.01, 4.01, 4.03, 4.08, 4.15, 5.05 and 7.03, (Ministry of Agriculture, 2007)

The above analysis suggests that the progress in the TFP-growth of rice immediately after agricultural trade liberalisation was driven by technological progress not by technical efficiency in rice production. This argument is evident from Figure 6.13. TFP-growth increased along with TC during 1986-87 to 1995-96. However, during 1995-96 to 1998-99, TC declined more sharply than TFP-growth making a significant gap between TFP and TC and suggesting that TE influenced TFP-growth more than TC for this period. This argument is supported by a sharp rise of TE over that period. From 1998-99 through to 2005-06, both TFP-growth and TC were below TE and the gap between TFP and TC was minimal suggesting that technological change influenced TFP-growth of rice in this period. This argument was supported by the distribution of the average TFP by five-year intervals over twenty years as shown in Table 6.3.

Figure 6.13: Total Factor Productivity and its component: 1986-87 to 2005-06



Source: Author's drawing using data from Table 7.2 of the above

From Table 6.3, it is clear that the highest value of the average TFP-growth (1.22) was associated with the period 1991-95. Similarly, the largest average TC value (1.21) was associated with the same period, whereas the average value of TE was one (1.00) during this period. This finding implies that the TFP-growth was mostly influenced by TC in this period. On the other hand, during 1996-2000 the growth in TFP was mostly weighted by the influence of TE, not by TC because the average value of TE (1.04) was greater than one but the average value of TC (0.99) was smaller than one. This analysis suggests that the TFP-growth of rice production was mostly influenced by technological change in the post-liberalisation period.

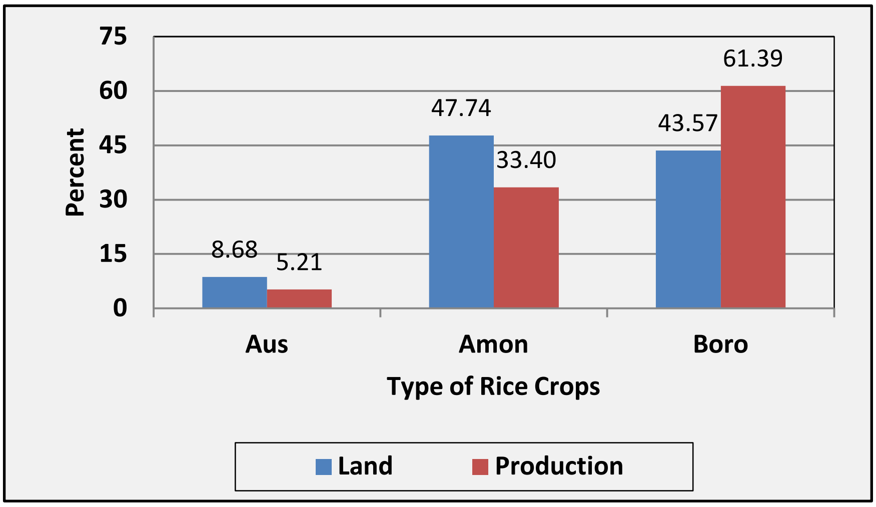
Table 6.3: Distribution of average TFP by five-year intervals: 1996-2005

Year	Total Factor Productivity (TFP)	Technical Efficiency (TE)	Technological Change (TC)
1986-90	0.97	0.96	1.01
1991-95	1.22	1.00	1.21
1996-00	1.03	1.04	0.99
2001-05	0.82	0.99	0.82

Source: Author's calculation from Table 7.2 of the above

The change in the TFP-growth of rice might be attributed to the shift of rice cultivation from local varieties to HYV rice and from Aus and Amon to Boro cultivation as a result of the technological transformation in rice production. This situation is revealed in Figure 6.14. Land is an important indicator of the proportional share of resources used by each crop because it is associated with the use of similar proportions of labour, irrigation, and seeds. In 2007-08, Boro rice used 43.57 percent of the total land for rice cultivation but it produced a much larger share of total rice output by 61.39 percent. On the other hand, both Aus and Amon produced a lower percentage share of rice output compared to the land they used for rice cultivation.

Figure 6.14: Share of land and production by major rice crops: 2007-08



Source: Author’s calculation from Table 2.01 and 1.03 (Ministry of Agriculture, 2007)

This is a clear indication that TFP-growth of rice was driven by the Boro crop, which is dominated by HYV rice. As revealed in the HHS 2010, Boro required more irrigation than any other crops, indicating that irrigation and HYV rice are the main driving forces for technological change that contributed much to the TFP-growth of rice during the post-liberalisation era.

Although Bangladesh experienced a significant increase in growth of total factor productivity of rice immediately after agricultural trade liberalisation, this trend was sustained for only one decade and then it started to decline sharply. The following section investigates the reasons why TFP-growth increased sharply immediately after agricultural trade liberalisation but declined sharply after one decade of experiencing high productivity growth in rice production and analyses the growth of factors of rice production and their intensity.

6.5 Growth of Factors and Inputs of Rice Production

In Bangladesh, the main factors and inputs of rice production are land, labour, and capital inputs such as fertilisers, irrigation, and pesticides. Agricultural trade liberalisation facilitated the rice farmers' reallocation of resources in favour of efficient rice crops and varieties for producing the maximum possible output from a given set of inputs and the level of technology. This section illustrates the growth of factors and inputs of rice production with a view to mapping out the changes in productivity of rice in the post-liberalisation era.

6.5.1 Growth of Land

Land is one of the most essential and fundamental factors of rice production in Bangladesh. Land is almost a constant factor, so the growth of land is usually insignificant over time. The growth of agricultural land also gradually declines because of rapid urbanisation, industrialisation, infrastructure development, and acquisition of agricultural land for housing to meet the increasing demand from rapid population growth. Bangladesh experienced little positive growth of land under rice cultivation during 1990-91 to 2005-06 as shown in Table 7.4. The total growth was 2.3 percent with an average of 0.1 percent per year during this period. Although this may appear insignificant, it reflected the importance of rice cultivation to meet the increasing demand for staple food (rice) of the growing population. In addition, land was reallocated from other agricultural activities to rice cultivation.

There was a significant reallocation of land amongst three major rice crops (inter-crop) and between two main rice varieties (intra-crop) as shown in the Table 6.4. This inter-crop and intra-crop reallocation of land influenced the cropping structure of rice in Bangladesh. The magnitude of growth in land for Aus and Amon was negative during 1990-91 to 2005-06. Aus crop experienced a large reduction in the growth of land by a total of −51.7 percent with an average of −3.2 percent per year over that period. Amon showed very steady growth in land and experienced a smaller negative growth rate by −3.4 percent over fifteen years with an average of −0.2 percent annually. Both Aus and

Amon released a significant proportion of land in favour of Boro cultivation, therefore Boro experienced a large positive growth rate of land by a total amount of 60.4 percent, with an average of 3.8 percent per year over the same period. This reallocation of land in favour of the more efficient Boro rice was the rational response of rice farmers for higher productivity and a larger volume of rice production.

Noticeably, the intra-crop reallocation of land was a shift of land from local varieties to the more productive HYV rice, as happened in the cases of all three main crops. Therefore, all three major crops – Aus, Amon and Boro – experienced a large negative growth in cultivable land for local varieties by –70.5, –39.9 and –39.4 percent respectively during 1986-87 to 2005-06. Conversely, all three crops experienced a high positive growth rate of land for HYV rice but the distribution of this growth was uneven across them – disproportionately the largest share was distributed in favour of Boro-HYV followed by Amon-HYV rice. Aus released the largest proportion of land from local varieties but received the lowest proportion of land for HYV rice with the lowest average growth rate of land for HYV rice reinforcing the previous argument that its land was reallocated in favour of Boro rice cultivation. Therefore, the increase in total factor productivity immediately after agricultural trade liberalisation might be attributed to the dynamic shift of the rice cropping structure from less efficient local varieties to more efficient HYV rice cultivation.

Table 6.4: Growth of the use of land under rice cultivation: 1990-91 to 2005-06

Types of rice	Total growth (percent)	Average growth per year (percent)
All rice	2.3	0.1
Major three types of rice		
Aus	-51.7	-3.2
Amon	-3.4	-0.2
Boro	60.4	3.8
Major two varieties of rice		
a) Local varieties		
Aus	-70.5	-4.4
Amon	-39.9	-2.5
Boro	-39.4	-2.5
b) High yielding varieties (HYV)		
Aus	34.5	2.2
Amon	67.7	4.2
Boro	73.2	4.6
Cropping intensity	**4.0**	**0.3**

Source: Author's calculation from Table 2.01 (Ministry of Agriculture, 2007)

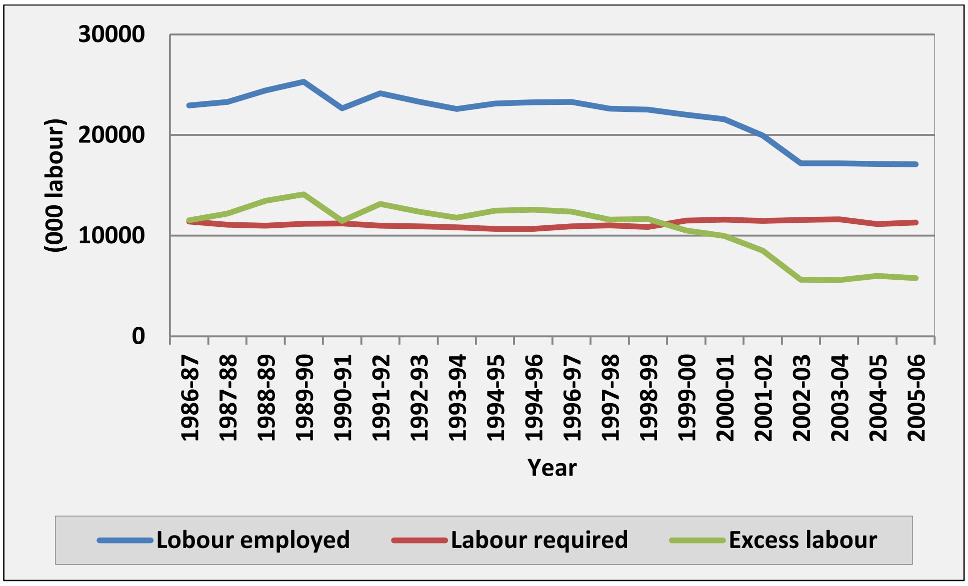
6.5.2 Labour

Family labour is the dominant supply of labour for rice cultivation in Bangladesh because the majority of farm households consist of small farmers and they are predominantly involved in subsistence farming. According to HHS-2010, 68.40 percent of farmers used family labour, 10.50 percent used hired labour, and 21.10 percent used both family and hired labour for rice production in 2010.

Rice cultivation in Bangladesh is highly labour-intensive because of the abundance of labour and fewer work opportunities compared to the available work force. As shown in Figure 6.15, there was a huge amount of excess labour employed in rice cultivation compared to its requirement. As revealed in HHS 2010, there is on average a requirement of 52.25 person-days for one acre or 128.82 person-days for one hectare of land to cultivate rice (from land preparing to harvesting). In Bangladesh, one labourer is required to work a minimum of 240 person-days in a year and is entitled for 28 person-days of annual leave (Section 7, The Employment of Labour (Standing Orders) Act, 1965). The study has calculated the required labour and excess labour based on this information.

The employment of excess labour beyond its requirement is bound to decrease productivity of labour in rice production. The study argues that the excess labour force employed in rice cultivation indicates wastage of productive resources in the form of under-employment or disguised unemployment. The figure of excess labour exceeded the required labour in rice cultivation during 1986-87 to 1998-99. It started to decline immediately after agricultural trade liberalisation and reduced drastically during 1999-2000 to 2005-06. The decline in the number of agricultural labourers could be attributed to opportunities for shifting the surplus labour to the rural non-farm sector and/or migration to urban centres. The development of the rural non-farm sector would facilitate the opportunities for more employment and income in rural areas.

Figure 6.15: Labour employment and requirement in rice cultivation: 1986-87 to 2005-06



Source: Author's calculation from data of various labour force surveys, and various years' statistical yearbooks of Bangladesh, Bangladesh Bureau of Statistics

As estimated from the Figure 6.15, the growth of required labour force for rice production increased slightly by an average of 0.14 percent per year during 1985-86 to 2005-06. There was a decline in the growth of both employed and excess labour for rice cultivation by an annual average of −1.80 and −3.46 percent respectively. This trend suggests that productivity of labour was likely to increase due to the reduction of excess labour from rice production.

6.5.3 Growth of Fertilisers, Pesticides and Seeds

The growth of both fertiliser and pesticide use were very significant during 1990-91 to 2005-06 as shown in Table 6.5. This is an indication that agricultural trade liberalisation facilitated rice farmers' greater access to fertilisers and pesticides. The average growth of fertilisers and pesticides per year were 4.7 and 10.1 percent respectively. However, the growth of rice seeds was negative by an average of −1.5 percent over the same period. This is likely to be because of an increase in the quality of rice seeds and the efficiency of farmers in using them.

Table 6.5: Growth of the use of fertilisers, pesticides, and seeds: 1990-91 to 2005-06

Types of input	Total growth (percent)	Average growth per year (percent)
Fertilisers	74.7	4.7
Pesticides	161.0	10.1
Seeds	-23.8	-1.5

Source: Author's calculation from Table 4.03, 4.14 and 4.09 (Ministry of Agriculture, 2007)

6.5.4 Growth of Irrigation

Agricultural trade liberalisation facilitated farmers' access to cheaper irrigation equipment. Thus, the irrigated land under rice cultivation increased, resulting in higher growth of irrigation use as shown in Table 6.6. All types of rice experienced an increase in irrigation by an average of 4.2 percent per year during 1990-91 to 2005-06. All crops – Aus, Amon and Boro – showed positive growth in irrigation. Amongst them Boro rice experienced the largest growth in irrigation by an average of 4.8 per year over the same period. As revealed in HHS-2010, Boro required more irrigation than any other rice crop because it is produced during the dry season when the requirement of irrigation is usually much higher due to lower supply of rainwater.

Table 6.6: Growth of irrigated land under rice cultivation: 1990-91 to 2005-06

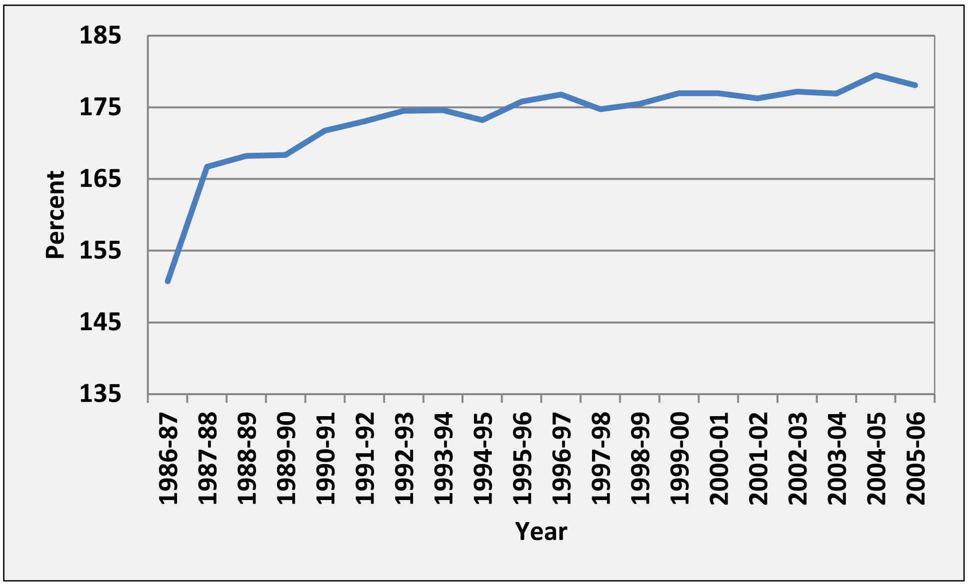
Types of rice	Total growth (percent)	Average growth per year (percent)
All rice	66.9	4.2
Major three types of rice		
Aus	36.8	2.3
Amon	43.2	2.7
Boro	76.8	4.8

Source: Author's calculation from Table 5.05 (Ministry of Agriculture, 2007)

6.5.5 Cropping Intensity

The technological transformation increased cropping intensity of rice immediately after agricultural trade liberalisation through increased use of fertilisers, irrigation, and HYV seeds. According to HHS-2010, the HYV rice requires a shorter time than local varieties of rice, resulting in higher cropping intensity of rice production. Although cropping intensity increased sharply from around 150 percent in 1986-87 to around 175 percent in 1992-93 immediately after agricultural trade liberalisation, this trend steadied in the subsequent years as shown in Figure 6.16. As revealed in HHS-2010, cropping intensity was limited because of agro-ecological reasons such as some land being suitable for only one crop in a year, as they remain submerged during the monsoon and rainy seasons. In this case, farmers have no alternative but to follow nature's order. Thus, the cropping intensity of rice maintained sluggish progress and an increase in the near future is unlikely given the agro-ecological constraints and current rice production technology.

Figure 6.16: Changes in the cropping intensity in rice production



Source: Author's calculation from Table 5.01 (Ministry of Agriculture, 2007)

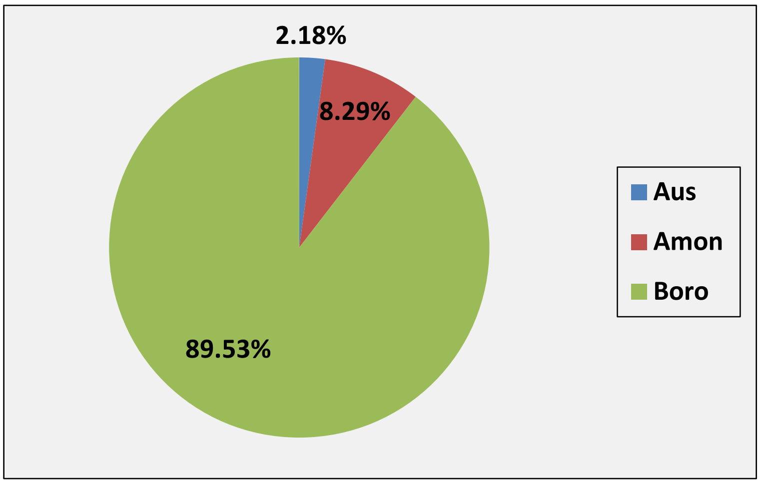
The above analysis suggests that the total factor productivity of rice increased immediately after agricultural trade liberalisation due to adoption of new technology, namely fertilisers-irrigation-HYV rice. Amongst these three inputs, irrigation had the greatest influence on productivity of rice because it is the prime input that influenced reallocation of resources (land, labour etc.) in favour of Boro rice cultivation and increased cropping intensity in the early stage of post-liberalisation era.

As calculated from Ministry of Agriculture statistics, the proportion of irrigated land gradually increased during 1986-87 to 2005. During 1986-90, the average irrigated area of total rice cultivated land was 19.18 percent per year whereas that ratio increased to an average of 34.53 percent per year during 2001-05. Therefore, irrigation facilitated the expansion of Boro rice cultivation.

As discussed in Chapter 5 (5.8.1.1), amongst the three rice crops, Boro is cultivated during the dry seasons (winter and spring), when water is available for irrigation. Farmers can control irrigation and apply fertilisers and pesticides on time, resulting in higher yields. Aus is cultivated during the dry season (summer) but water is not available for irrigation, resulting in lower yields. Conversely, Amon is cultivated during the wet (rainy) season, when farmers have little control over rainwater. Therefore, there are two main reasons for reallocation of land to Boro crop: (1) Boro is the most productive rice crop; the respondents of HHS 2010 opined that rice production became more competitive than other crops in the post-liberalisation era; 2) the majority of farm households are subsistent and small farmers, who are poor and are much more interested in producing rice as a staple food than producing other food-grains and cash crops, leading to reallocation of resources in favour of the most productive Boro rice.

The significant increase in Boro rice production was possible because of the wider availability of small-scale imported irrigation equipment such as shallow tube-wells and low lift pumps as well as other inputs such as fertilisers and HYV seeds following agricultural trade liberalisation. As shown in Figure 6.17, Boro accounted for 89.53 percent of total irrigated land, implying that the expansion of Boro rice cultivation was possible due to the availability of irrigation.

Figure 6.17: Share of irrigated land by major three rice crops: 2005-06



Source: Author's calculation from Table 5.05 (Ministry of Agriculture, 2007)

This analysis suggests that the increase in productivity of rice immediately after agricultural trade liberalisation was much influenced by new technology, combined with the effect of fertilisers-irrigation-HYV seeds. The impact of this technology on the productivity of rice gradually slowed down. This decline might be attributed to technological non-progress as technology gradually becomes obsolete after its adoption if innovation, and research and development (R&D) are not sufficient to replace the old technology, suggesting that technological innovation in rice production through R&D is required to increase total factor productivity growth of rice in future. This productivity growth in the post-liberalisation era is much attributed to the shift of cropping patterns in favour of more productive HYV rice and specially Boro crops. Amongst all inputs, HYV seeds and irrigation are dominant contributors to this growth and the increase in the volume of rice production over last two decades. The regression analysis presented in the following section reinforces this argument.

6.6 Regression Analysis

Ordinary least square (OLS) regression analyses were carried out to critically examine how agricultural trade liberalisation influenced rice production and household welfare. Both output and input models were used to examine the impacts of particular inputs and outputs on total rice production. In addition, factors' income (total revenue) from rice production was used separately with a view to determining the relationship between farm-household income from rice and factors of rice production. The findings were very consistent with previous analysis and reinforced the proposition that agricultural trade liberalisation impacted on rice production significantly through increasing productivity of rice as a result of technological transformation and reallocation of resources towards more efficient rice crops.

6.6.1 Output Oriented Analysis

Aus, Amon and Boro are the only crops that constitute total rice production in Bangladesh. Agricultural trade liberalisation facilitated farmers' adoption of new technology with a combination of fertiliser-irrigation-HYV seeds and reallocation of their resources in favour of more efficient rice crops. As illustrated earlier, farmers reallocated land in favour of more productive Boro rice. Thus, both Aus and Amon crops gradually released land (mostly Aus) to Boro rice cultivation. Aus gradually became the least important and Boro became the most dominant crop to determine total rice output. As shown in Table 6.7, the correlation between Aus and total rice production was negative (–0.650) and the regression coefficient for Aus crop was not statistically significant. This model suggests that the Aus crop was unlikely to have an impact on determining total rice production.

On the other hand, Boro and Amon crops have strong correlation with total rice production. The correlation coefficients for Boro and Amon are 0.948 and 0.805 respectively. The regression coefficients for both Boro and Amon crops are positive and statistically significant at the level of 1 and 5 percent respectively. As expected, the regression coefficient for Boro crop was the highest (0.817) suggesting that amongst three crops Boro was the most important determinant of total rice output. An increase in one unit of Boro crop is likely to increase total rice production by 0.817 units. Similarly, the regression coefficient for Amon was 0.236, indicating that an increase in one unit of Amon crop is likely to raise total rice production by 0.236 units. This model has reinforced the proposition that the increase in productivity of rice output might be mostly attributed to the increase in productivity of Boro crop.

Table 6.7: Determinants of output by major rice crops: 1986-87 to 2005-06
(**Dependent Variable:** Total rice production)

Independent variables	Regression coefficient	*Correlation coefficient*
Aus production	.061 (.787)	-.650
Amon production	.236 (.298)**	.805
Boro production	.817 (.143)***	.948
R-square: 0.925; df1: 3, df2: 16; F: 65.989; P: .000		

Note: Amon refers to T-Amon only; and B-Amon excluded from this analysis as B-Amon is not influenced by the technology – a combination of irrigation-fertilisers-HYV seeds.
*** significant at 1%, and ** significant at 5% level; figures in parentheses represent standard errors.

As illustrated earlier, agricultural trade liberalisation facilitated farmers' shifting of resources from less-efficient local varieties to more productive HYV rice, resulting in a significant increase in the volume of rice production. The following OLS regression analysis supported the previous argument that HYV rice is the main contributor to total rice production as shown in Table 6.8.

The correlation between total rice production and each of the local varieties of rice was negative as shown in the correlation coefficient column. On the other hand, the correlation between total rice production and each of the three HYV rice varieties was positive. HYV-Boro had the largest correlation coefficient (0.948) followed by HYV-Amon (0.933) and HYV-Aus (0.594). This is a significant indication that total rice production is positively associated with HYV rice and they move in the same direction.

In the regression analysis, no crops by local varieties are statistically significant, suggesting that local varieties of rice are highly unlikely to have impacts on determination of total rice production. For HYV rice, HYV-Boro and HYV-Amon are positive determinants of total rice production with the regression coefficients of 0.681 and 0.565 respectively. Only these two variables are statistically significant for predicting the value of dependent variable – total rice production. This model suggests that one unit increase in HYV-Boro and HYV-Amon rice is likely to increase total rice production by 0.681 and 0.565 units respectively. On the other hand, HYV-Aus crop is very unlikely to influence total rice output.

Table 6.8: Determinants of output by varieties of rice: 1986-87 to 2005-06

(**Dependent variable:** Total rice production)

Independent variable	Regression coefficient	Correlation coefficient
Local-Aus	.292 (1.347)	-.774
HYV-Aus	.066 (2.354)	.594
Local B- Amon	.165 (2.678)	-.562
Local T-Amon	-.134 (1.176)	-.662
HYV-Amon	**.565** (.386)***	.933
Local-Boro	.028 (8.803)	-.414
HYV-Boro	**.681** (.176)***	.948
R square: 0.969; Df1: 7, df2: 12; F: 52.774 ; P: .000		

Note: figures in parentheses represent standard errors; *** significant at 1% level

6.6.2 Input Oriented Analysis

A factor-oriented (input) regression analysis was carried out with a view to identifying the impact of individual inputs or factors on total rice production. The study estimated the Cobb-Douglas production function to investigate determinants of output. It used two separate log-linear OLS regression models – Model 1 (pre-liberalisation, 1971-72 to 1985-86) and Model 2 (post-liberalisation, 1986-87-2005) with a view to making a comparison between pre-liberalisation and post-liberalisation scenarios. The factors of production considered in these models were land, labour, irrigation, fertilisers, pesticides and seeds. However, both models excluded some factors, which were not statistically significant. The results are shown in Table 6.9.

In Model 1, the regression coefficients for land, fertiliser and pesticides were positive and were found statistically significant in the pre-liberalisation period. Amongst these three factors, land was the largest determinant with a regression coefficient of 0.420 and pesticide was the smallest determinant (0.226) of output. Similarly, in Model 2, irrigation was the largest contributor to rice production with a regression coefficient of 1.342 in the post-liberalisation period. Other two factors labour and fertilisers were statistically significant but both factors had negative regression coefficients with –0.336 and –0.643 respectively. This study suggests that there is an inverse relationship between total rice output and labour as well as between total rice output and fertilisers. This is because excess labour is employed in rice production in Bangladesh. The productivity of labour is negative and therefore, an increase in labour by one unit is likely to decrease total output by 0.336 units. This model suggests that excess labour employed in rice production constitutes wastage of resources in the rural economy and that might be better used for other productive activities. Therefore, removal of excess labour from rice production would likely increase productivity of labour for rice output. Similarly, the negative impact of fertilisers on total rice production might be attributed to the inappropriate application of cheap fertilisers to rice cultivation in the post-liberalisation period as revealed in the HHS 2010.

Irrigation had a very large and positive regression coefficient (1.342), indicating that an increase in one unit of irrigation was likely to increase the total rice production by 1.342 units, suggesting that rice productivity was driven by irrigation-related crops (mainly HYV-Boro) in the post liberalisation era. This finding has significant implications that irrigation-oriented technology was dominant factor in determining the productivity of rice in the post-liberalisation period.

Table 6.9: Determinants of output by factors of production

(**Dependent variable:** Logarithm of total rice production)

Independent variables	**Model 1 (pre-liberalisation) (1971-72 to 1985-86)**		**Model 2 (post--liberalisation) (1986-87 to 2005-06)**	
	Regression coefficient	**Correlation coefficient**	**Regression coefficient**	**Correlation coefficient**
Log of total land	.420 (.392)***	.913	excluded, not significant	
Log of total irrigated area	excluded, not significant		1.342 (.215)***	.924
Log of total fertiliser use	.410 (.037)***	.941	-.643 (.233)*	.837
Log of total pesticide use	.226 (.049)	.881	excluded, not significant	
Log of total labour employed	excluded, not significant		-.336 (.129)**	-.897
	R-square: 0.960 df1: 3, df2: 11 F: 88.031, P: .000		**R-square: 0.964 df1: 3, df2: 16 F: 128.570, P: .000**	

Note: time series data used, number of observations for Model-1 are 15 (15 years' data from 1971-72 to 1985-86) and for Model-2 are 20 (20 years' data between 1986-87 and 2005-06)
excluded variables are not statistically significant
figures in parentheses represent standard errors
*** significant at 1%, ** significant at 5% and * significant at 1% level

[Data source: *Handbook of Agricultural Statistics, December 2007*,Ministry of Agriculture, Government of Bangladesh [Online]: http://www.moa.gov.bd/statistics/statistics.htm, [retrived 15 May 209]; and statistical yearbooks of various years, BBS]

6.6.3 Factor Price and Income Analysis

Factor price is associated with the use of factors for rice production. It is the cost to producers and earnings for the factor owners. Some factor-costs are at the same time the earnings of the same households. For instance, the majority of farm households in Bangladesh use family labour for rice production. In this case, the labour cost (wages) is both a cost and an income for the same household. Using data from HHS-2010, an OLS regression analysis is carried out to investigate the impact of factor costs and earnings on household income (welfare) from rice production. As shown in Table 6.10, the results of the regression model suggest that wage had a negative impact on determining household income from rice production, reinforcing the previous analysis that labour negatively affected the productivity of rice. All other factor costs such as rent, capital cost, and profit are positive determinants of household income from rice production. Amongst them, profit is the largest determinant with a value of highest regression coefficient (0.621). This model suggests that household income from rice cultivation is largely determined by how inputs and factors of rice production are managed (organised), implying that an increase in one unit of management/organisational skill is likely to increase households' income from rice by 0.621 units. This study argues that the management/organisation factor plays an important role in determining income of farm households.

Table 6.10: Determinants of household income (revenue) from rice: 2010
(**Dependent variable**: household income from rice production)

Independent variable	Regression coefficient
Rent (use value of land)	.125 (.173)***
Wage (labour)	-.240 (.095)***
Capital cost (capital/inputs)	.496 (1.191)***
Profit (factor-management/organisation)	.621 (.013)***
R-square: 0.984; df1: 4, df2: 33; F: 285.093; P: .000	

Note: figures in parentheses represent standard errors; *** significant at 1% level

6.7 Conclusion

The above findings and analysis suggest that agricultural trade liberalisation positively influenced productivity of rice as a result of technological transformation in rice production. The economy experienced an increase in total factor productivity growth driven by technological change in the post-liberalisation era. The improvement in productivity of rice contributed to a higher volume of rice output. The increase in productivity and total output was driven by cropping shifts from local varieties to HYV rice and reallocation of resources in favour of HYV-dominated Boro rice in the post-liberalisation era. The use of irrigation, fertilisers, pesticides, and HYV seeds increased in the post-liberalisation era because of lower input prices resulting from agricultural trade liberalisation.

The impact of technological change on the total factor productivity growth of rice gradually slowed after the first decade of high growth in productivity of rice. This analysis suggests that research and development activities are required to strengthen technological innovation for improving technological change in rice production to achieve and sustain higher productivity growth in future. Similarly, there is a huge amount of excess labour employed in rice production. This excess labour may be reallocated to other sectors for increasing productivity of labour in rice output and will contribute to higher household income from economic activities other than rice production. The intensive and efficient use of factors is crucial for increasing technical efficiency in rice production that will contribute to the total factor productivity growth as well.

Although agricultural trade liberalisation increased rice productivity, the distributional consequence of welfare amongst different groups of rural households requires further analysis. The increase in productivity of rice and the volume of output might have influenced household welfare through changing output prices and their real income. The following chapter, Chapter 7, analyses the distributional impacts of the consequences of agricultural trade liberalisation on the welfare of rural households.

CHAPTER SEVEN

Agricultural Trade Liberalisation: Changes in Rice Prices and Household Welfare

7.1 Introduction

The preceding chapter examined how agricultural trade liberalisation influenced productivity of rice through technological transformation in rice cultivation. However, no attempt was made to analyse its impact on changes in rice prices and household welfare. This chapter analyses how agricultural trade liberalisation influenced both consumer and producer prices of rice; and how changes in rice prices, in turn, affected the welfare of rural households. The changes in welfare of rural households are analysed through changes in their income and consumption. Household characteristics are used as the endowments of households for determining household types such as farmers, agricultural labourers, non-farm households, etc.

This chapter investigates the growth in real income of rural households, using quintile analysis by dividing all households into five groups (quintiles) to trace the incidence of growth in real income. It also uses growth incidence curves to map out and compare growth in real income experienced by different groups of rural households such as farmer, non-farmer, net seller, net buyer, etc. It decomposes income growth by sources with a view to separating the impact of the share of agricultural income on real income growth. Determinants of income as well as determinants of growth in real income are identified using OLS regression analysis. Both economic and non-economic characteristics of rural households are considered to identify the determinants of income using the base year's household characteristics as initial endowments and the current year's household characteristics as current endowments for a comparative analysis of changes in household welfare.

This chapter also analyses the changes in household consumption, critically examining changes in household consumption patterns, elasticity of demand for consumption, determinants of consumption and growth in real consumption.

7.2 Change in Prices of Rice and Household Welfare

Agricultural trade liberalisation contributed to the increase in productivity of rice, resulting in higher volumes of rice production during 1985-86 to 2005. Since the government put a ban on rice exports, the increased volume of rice production also increased the supply of rice in the domestic market, leading to a decrease in rice prices. An estimate using data from HHES-1985-86 and HHIES-2005 indicates that both producer and consumer prices of rice decreased during this period. The producer price declined by a total of 22.78 percent with an average of 1.14 percent per year and the consumer price decreased by 13.95 percent with an average of 0.70 percent per year over the same period as shown in Table 7.1. The decrease in rice price was supported by survey data of HHS-2010. Amongst rural households, 98.3 percent of respondents opined that the price of rice in real terms decreased during 1990-2010. A decrease in the producer price implies a decline in welfare of rice farmers whereas a decrease in consumer price suggests an increase in the welfare of rice consumers. The magnitude of decrease in producer price is much greater than the decrease in the consumer price, indicating that rice traders or intermediaries between producers and consumers gained largely from this liberalisation process. It also indicates that there is some imperfection in the rice market and this proposition is reflected in the survey data. As discussed in Chapter Five (5.9.4.2), most respondents of the HHS-2010 expressed the opinion that the rice market in rural areas was dominated by rice syndicates (groups of rice traders) and they were predominantly urban traders in association with rural elites (managers of rural rice markets).

Table 7.1: Change in producer and consumer prices of rice during 1985-86 to 2005

Price type	Total change (percent)	Average change per year (percent)
Producer price	-22.78	-1.14
Consumer price	-13.95	-0.70

Source: Author’s calculation using data from BBS HHES 1985-86 and HHIES 2005

A disproportionate decrease in producer and consumer prices of rice affected the income distribution and welfare of rural households in accordance with their involvement with the rice market. The change in welfare of rural households was reflected in their income and consumption, which is analysed in the following sections.

7.3 Welfare Measures: Income and Consumption

Income and consumption are the basic and useful measures of welfare of rural households as they capture the means by which households can achieve human well-being. They tend to highly correlate with each other because household consumption derives from income. Amongst these two measures, income is an indirect measure and consumption is a direct measure of welfare. Household consumption has a significant impact on income and expenditure. It directly depends on household income and again influences household income through consumption multiplier effects – through changes in demand, employment, and production. Therefore, consumption itself is a direct indicator of household welfare as well as a contributor to income – an indirect measure of welfare. The study has used both measures – income and consumption – to analyse household welfare with a view to providing a better understanding of the impacts of agricultural trade liberalisation on the welfare of rural households.

7.3.1 Income and Household Welfare

7.3.1.1 Real Income Growth and Household Welfare

The descriptive statistics of household income are presented in Table 7.2. All household groups experienced an increase in mean income but standard deviations for all groups of rural household income increased significantly in 2005 compared to their levels in 1985-86, indicating that there was significant dispersion of household incomes from their respective mean – suggesting a larger inequality in income distribution.

Table 7.2: Descriptive statistics: household income by household types, 1985-86-2005

Household type	1985-86		2005	
	Mean (taka)	Std. Deviation	Mean (taka)	Std. Deviation
All rural households	2168.61	1359.93	6043.61	7122.08
Farm household	2479.70	1465.11	6559.09	8091.20
Non-farm household	1406.96	571.30	4718.07	3361.88
Large farmer	5236.80	3013.95	34950.00	27625.24
Medium farmer	4070.27	589.59	10899.14	7637.13
Small farmer	2252.07	541.56	4786.45	2581.47
Agricultural labourer	1148.41	322.11	2343.92	1258.38

Source: Author's calculation using data from HHES 1985-86 and HHIES 2005

An increase in productivity of rice and simultaneously a decrease in the price of rice jointly affected the welfare of rural households through distribution of income. Although other factors might also have affected the growth in real income of rural households, agricultural trade liberalisation is the most important policy reform because of households' critical dependence on rice in terms of both income and consumption.

Table 7.3 shows the impacts of agricultural trade reforms on the growth in real income of different groups of rural households during 1985-86 to 2005. All rural households as a group experienced an increase in growth of real income by an average of 2.74 percent per year. The non-farm households experienced a higher increase in real income growth with an average of 4.33 percent per year than that of farm households with an average of 1.90 percent during the same period. This is arguably because agricultural trade liberalisation significantly impacted on the growth of the rural non-farm sector through the multiplier effects. The HHS-2010 identified significant growth in the rural non-farm infrastructure such as markets, rice mills, agricultural equipment repair workshops and transportation logistics during the post-liberalisation era.

Amongst the farm households, medium and large farmers experienced the highest income growth with an average of 2.68 percent per year. The annual average growth rate of real income for small farmers and agricultural labourers were 1.58 and 2.08 percent respectively. In terms of household involvement with the rice market, net buyers gained a much higher average growth in real income with an average of 3.56 percent per year than that of net sellers with an average of only 1.24 percent. Amongst all groups of rural households, small farmers experienced the least growth in real income. This is because the majority of small farmers are both sellers and buyers of rice. They sell rice during harvest (peak) seasons at the lowest price to repay loans and meet essential household expenditure, and then buy rice during lean seasons at the highest price to meet household rice consumption. There were remarkable seasonal variations in producer and consumer prices of rice. In 2005, it is estimated that the producer and consumer prices of rice varied by 18.87 and 10.01 percent respectively over the peak and lean seasons. The HHS-2010 revealed that small farmers sold rice during peak seasons. Amongst small farmers, 57 percent sold rice during the peak season, 7 percent during the lean season, 33 percent in the both peak and lean seasons but mostly in the peak season, and 3 percent in both seasons but mostly in the lean season. On the contrary, 67 percent of them were rice buyers and they bought rice only during lean seasons. Therefore, small farmers experienced loss in both cases of rice selling and buying. Compared to this scenario, 25 percent of large and medium farmers sold rice during lean seasons and 75 percent in both peak and lean seasons but mostly in lean seasons.

Amongst the poor farm households, agricultural labourers experienced a higher income growth than that of small farmers, even higher than that of all farm households. This situation suggests that they received higher real income during that period because they were net buyers of rice and they bought rice at a lower price because 100 percent of agricultural labourers were net buyers. The HHS-2010 revealed that 93 percent of them bought rice during both peak and lean seasons equally and 7 percent bought during peak seasons. Similarly, agricultural labourers enjoyed higher wages with greater opportunities of employment during 1990-2010. Amongst the agricultural labourers, 86 percent of respondents confirmed an increase in nominal wages and 100 percent opined that there was a greater opportunity for employment during this period than pre-liberalisation era. This result suggests that agricultural labourers experienced higher growth in real income through higher wages with higher opportunity for employment and lower rice prices. This is an indication that agricultural trade liberalisation generated greater opportunities for employment and income for agricultural labourers.

Non-farm households experienced a higher growth in real income with a lower consumer price of rice. According to the HHS-2010, amongst the non-farm households, 57 percent bought rice during peak seasons at the lowest price of the year and 43 percent bought during both peak and lean seasons equally. This finding suggests that non-farm households, being net buyers, gained the most from the lower rice price amongst all groups of rural households.

From the quintile analysis in Table 7.3, it is clear that rich households experienced higher average growth in real income than poor households, irrespective of all groups of rural households. The first quintile (Q-1) represents the bottom 20 percent income group (the poorest) and the fifth quintile (Q-5) represents the top 20 percent income group (the richest) for each group of rural households. The rate of pro-poor growth represents the mean growth rate of income for all quintiles of a particular group of households. This rate is less than the growth rate of real income in mean for all groups of rural households, suggesting that income growth during 1985-86 to 2005 was not pro-poor.

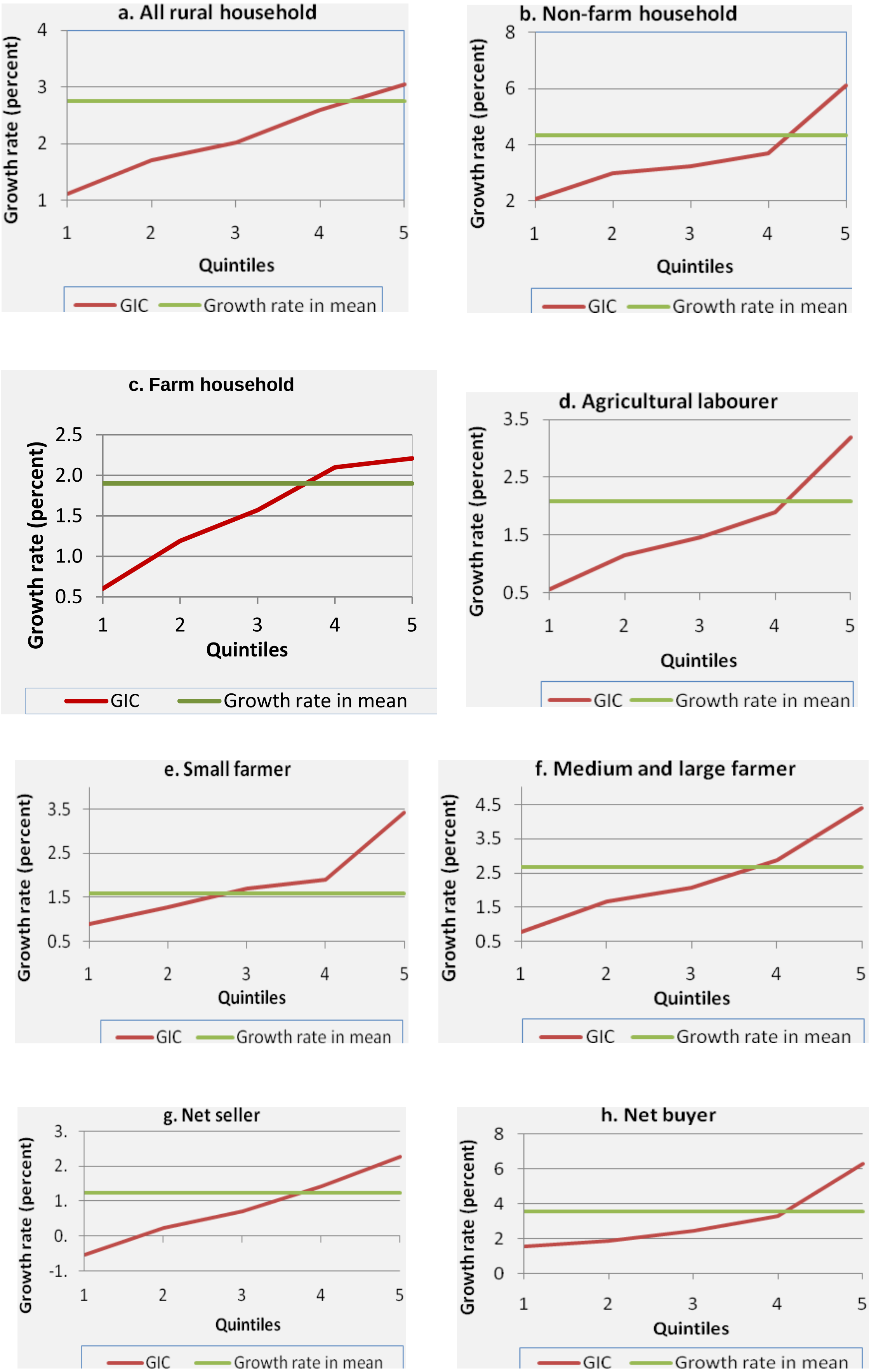
Table 7.3: Annual average growth in real income by household types during 1985-86 to 2005

	Quintile income growth rate (percent)					Average growth rate (percent)	
Household type	**Q-1**	**Q-2**	**Q-3**	**Q-4**	**Q-5**	**Rate of Pro-poor Growth (mean of quintile growth rates)**	**Growth rate in mean**
All rural households	1.11	1.70	2.02	2.60	3.04	2.10	2.74
Non-farm household	2.06	3.00	3.25	3.68	6.12	3.62	4.33
Farm household	0.60	1.19	1.57	2.10	2.21	1.53	1.90
Agricultural labourer	0.57	1.14	1.46	1.89	3.20	1.65	2.08
Small farmer	0.90	1.27	1.70	1.89	3.42	1.83	1.58
Medium and large farmer	0.79	1.67	2.06	2.89	4.41	2.36	2.68
Net seller	-0.54	0.24	0.71	1.43	2.28	0.82	1.24
Net buyer	1.52	1.89	2.46	3.28	6.28	3.09	3.56

Source: Author's calculation using data from HHES 1985-86 and HHIES 2005

The growth in real income experienced by different groups of rural households can also be presented with growth incidence curves. The growth incidence curve demonstrates the growth in real income by quintile and presents the distribution of growth in income for different household groups as shown in Figure 7.1. Growth incidence curves revealed that all rural households experienced moderate to high-income growth during 1985-86 to 2005. The poor households for all groups of the rural communities experienced a lower growth in real income than the average growth rate of their own particular household groups, indicating that the poor benefited less than the rich from agricultural trade liberalisation. Similarly, income growth of the poorest farm households (lowest quintile) is much lower than the average income growth of the lowest quintile (the poorest) of non-farm households and a lower than the average income growth of all rural households as a group. This evidence suggests that agricultural trade liberalisation benefited non-farm households more than farm households. For the same reason, net-buyers gained more than net-sellers from these policy reforms. Small farmers experienced an even distribution of income growth more than any other groups of rural households because of their homogenous and non-diversified income from rice and a similar pattern of involvement with the rice market – most of them sell rice during harvest seasons at lower producer prices and buy rice during lean seasons at higher consumer prices.

Figure 7.1: Growth Incidence Curves (GIC) – real income growth rate: 1985-86 to 2005



7.3.1.2 Decomposition of Income Growth

The above finding is reinforced by the results of a decomposition of growth in real income – an illustration of the importance of the growth links during 1985-86 to 2005. The decomposition of income growth for different groups of rural households is presented in Table 7.4. The contribution of each source of income is presented in such a way that their sum equals the total income growth experienced by different income groups of rural households by quintile income distributions. During 1985-86 to 2005, out of 2.74 percent of average real income growth in mean for all rural households, wage and salary contributed the highest by an average of 0.81 percent followed by business-commerce with a contribution of 0.76 percent to the real income growth in mean. Although agriculture is the largest income component of rural households, the contribution of agriculture to this income growth was only 0.62 percent, indicating that the income growth of rural households was mainly attributed to non-agricultural components. The share of income from gift-remittance-assistance was the largest contributor to income growth for poor households (Q-1, Q-2, and Q-3) whereas wage–salary and business–commerce played an important role in the income growth of rich households (Q-4 and Q-5). Considering agricultural contribution, rich households (Q-4 and Q-5) experienced higher income growth from agriculture than poor households (Q-1, Q-2, and Q-3). The contribution of agriculture to the growth in real income of rural households might be attributed to the improved productivity of rice resulting from agricultural trade liberalisation because the households' share of agricultural income in rural areas was dominated by income from rice.

Table 7.4: Decomposition of annual average growth in real income by sources: 1985-86 to 2005

Sources	Growth rate in mean (%)	Growth rate in quintiles (%)				
		Q-1	*Q-2*	*Q-3*	*Q-4*	*Q-5*
All rural households	2.74	1.11	1.70	2.02	2.60	3.04
Agriculture	0.62	0.02	0.19	0.27	0.53	0.73
Wage and salary	0.81	0.13	0.51	0.61	0.92	1.09
Business and commerce	0.76	0.01	0.17	0.45	0.75	0.81
House rent	0.05	-0.01	0.01	-0.02	0.01	0.10
Gift, remittance and assistance	0.34	0.95	0.63	0.65	0.14	0.16
Other sources	0.17	0.01	0.19	0.06	0.25	0.17

Source: Author's calculation using data from BBS HHES 1985-86 and HHIES 2005

Table 7.5 presents the picture of changes in patterns of the shares of major components of household income in rural areas during 1985-86 to 2005. The share of agricultural income gradually declined from 39.5 percent in 1985-86 to 28.7 percent in 2005. Nonetheless, agriculture remained the largest component of income of rural households followed by wage-salary. The share of income from gift-remittance-assistance increased significantly from 0.5 percent to 12.0 percent over the same period. Wage-salary and business-commerce held a steady increase over the same period. This result reinforced the argument that there was significant growth in the rural non-farm sector and the improved productivity of rice resulting from agricultural trade liberalisation might have contributed to this growth.

Table 7.5: Share of household income by source (in percent): 1985-86 to 2005

Year	Agriculture	Wage and salary	Business and commerce	House rent	Gift, remittance and assistance	Other sources
2005	28.7	28.1	17.3	5.1	12.0	8.7
2000	25.5	27.7	22.4	5.0	11.0	8.4
1995-96	35.4	27.7	14.7	6.5	9.6	6.1
1991-92	40.1	21.1	12.4	9.1	10.6	6.7
1988-89	38.3	7.11	15.1	9.6	6.8	23.1
1985-86	39.5	22.7	14.9	6.0	0.5	16.4

Source: Compiled from BBS HHES-1985-86 (Table 4.3, P-33) and HHIES-2005 (Table 4.4, P-31)

7.3.1.3 Determinants of Household Income and Welfare: OLS Regression Analysis

This study investigated the determinants of household income to explore the basic sources of the welfare of rural households. Households' economic and non-economic characteristics were used to identify determinants of household income. The economic characteristics include size of land owned by households, sources of income such as agriculture, rice, wage-salary, business-commerce, gift-remittance-assistance, house rent, and other sources of income. The non-economic characteristics include household size, household type, household head's age, gender and education. Some dummy variables were used to capture the impacts of specific household characteristics on income. These variables were being landless or not, whether a net seller or not and household involvement with farming such as small farmer, medium farmer or agricultural labourer.

Two separate OLS regression models were carried out for 1985-86 (base year) and 2005 (current year) for making a comparison between the base year and current year's determinants of income. It was also assumed that the base year's household characteristics were initial endowments and the current year's characteristics were current endowments of rural households. In regression analysis, only statistically significant variables were considered for analytical purposes and other variables were dropped from the regression summary tables to give more precise and accurate interpretations about the role of independent (explanatory) variables in explaining dependent variables. The regression models are justified for consideration on the basis of core standard criteria such as high r-square values, low standard errors, and statistically significant (high t-values) explanatory variables in explaining the dependent variables. The F value and p-value of each regression model are also considered in order to conclude whether a model is statistically significant or not.

Combining economic and non-economic characteristics and considering simultaneously their joint effects on household income, the OLS regression models revealed that non-economic factors were not statistically significant, indicating that they had no influence in determining household income in both 1985-86 and 2005. This result is presented in Table 7.6.

In 1985-86, the positive determinants of household income were household size, household land area, farm household dummy, net seller dummy, and five sources of income shares including agriculture, business-commerce, house rent, gift-remittance-assistance, and other sources. Amongst them, household size was the largest positive determinant of household income with a regression coefficient of 0.405 followed by farm household dummy (0.315) and share of agricultural income (0.292) in the same year. The negative determinants of household income were three dummy variables – net seller, medium farmer and small farmer in 1985-86. The small farmer dummy had the largest negative impact on household income with a regression coefficient of –0.371 followed by agricultural labourer dummy (–0.273) and medium farmer dummy (–0.103) in the same year.

Similarly, in 2005, the positive determinants of household income were household size, household land area, three dummy variables – medium farmer, small farmer, and agricultural labourer, and three shares of income from agriculture, business-commerce, and house rent. Amongst them, household size was the largest determinant of household income with a regression coefficient of 0.442 followed by agricultural labourer dummy (0.371) and small farmer dummy (0.351) in the same year. The negative determinants of household income were farm household dummy variable, share of rice income, and share of gift-remittance-assistance income in 2005. Amongst them, farm-household dummy variable was the largest negative determinant of income with a regression coefficient of –0.393 followed by the share of rice income (–0.091) and the share of income from gift-remittance-assistance (–0.072) in the same year.

Household size and land area were positive contributors to household income in both 1986-86 and 2005. Similarly, three shares of income from agriculture, business-commerce, and house rent were positive determinants of income in both years. Although three dummy variables – medium farmer, small farmer, and agricultural labourer – were negative contributors to household income in 1985-86, they were positive determinants in 2005. On the other hand, farm household dummy and share of income from gift-remittance-assistance were positive determinants of household income in 1985-86 but they were negative determinants in 2005. Two variables – net seller dummy and share of income from other sources were positive contributors to household income in 1985-86 but they were not statistically significant in 2005.

Conversely, landless dummy and share of income from rice were negative determinants of household income in 2005 but they were not statistically significant in 1985-96. Although rice is the staple food in Bangladesh, shares of income from rice had negative regression coefficients in both 1985-86 and 2005, suggesting that share of rice income was not a determinant of household income.

Table 7.6: Determinants of household income: 1985-86 and 2005
(Dependent variable: Logarithm of household income)

	Model 1 (1985-86)	**Model 2 (2005)**
Independent Variables	**Regression Coefficients**	
Household size	.405 (.019)***	0.442 (.044)***
Household land area	.170 (.008)***	0.307 (.025)***
Landless dummy	Excluded, not significant	-0.067 (.085)**
Medium farmer dummy	-.103 (.078)**	0.291 (.238)***
Small farmer dummy	-.317 (.096)***	0.351 (.269)***
Agricultural labourer dummy	-.273 (.098)***	0.371 (.288)***
Farm household dummy	.315 (.098)***	-0.393 (.293)***
Net seller dummy	.118 (.034)***	Excluded, not significant
Share of agriculture income	.292 (.526)***	0.091 (.944)*
Share of rice income	-.008 (0.71)	-0.097 (.115)**
Share of business and commerce income	.232 (.577)***	0.285 (.955)***
Share of house rent income	.080 (2.086)**	0.039 (1.355)*
Share of gift, remittance and assistance income	.141 (1.193)***	-0.072 (.608)*
Share of other sources income	.183 (.540)***	-0.029 (.438)
	R-square: 0.987 **df1: 13 ; df2: 84** **F: 485.360; P-value: .000**	**R-square: 0.961** **df1: 13 ; df2: 86** **F: 162.128 ; P-value: .000**

Note: Share of wage-salary income was excluded from the model to avoid multicollinearity problem, as this variable was not statistically significant
Figures in brackets represent respective standard errors.
* Significant at 10%; ** significant at 5%; *** significant at 1% level

7.3.1.4 Determinants of Real Income Growth

As discussed in the previous sections, all rural households experienced a moderate to high rate of growth in real income during 1985-86 to 2005. Non-farm households experienced higher income growth than farm households. This suggests that non-farm factors must be more important than farm factors in determining the growth in real income of rural households. The determinants of income growth were justified based on both initial and current endowments of households for comparative analysis with a view to understanding the impact of agricultural trade liberalisation on the welfare of rural households. In Table 7.7, Model 1 represents base year's (1985-86) endowments and Model 2 represents current year's (2005) endowments in determining the growth in real income of rural household. These regression models included some difference variables as the proxy for changes in household endowments, with an assumption that a change in the share of income of a particular component reflects the change in household endowments. These difference variables are changes in the shares of income from seven sources including agriculture, rice, wage-salary, business-commerce, house rent, gift-remittance-assistance, and other sources.

In 1985-86, the positive determinants of income growth were household land area, net seller dummy, changes in shares of income from agriculture and house rent. Amongst them, household land area was the largest determinant of growth in household real income with a regression coefficient of 0.369 followed by change in share of agricultural income (0.118) and net seller dummy variable (0.085). Conversely, the negative determinants were shares of income from four sources (wage-salary, business-commerce, gift-remittance-assistance, and other sources) and changes in share of income from three sources (wage-salary, gift-remittance-assistance, and other sources) in the same year. Amongst them, share of income from wage–salary was the largest negative determinant of growth with a regression coefficient of –0.486 followed by share of income from other sources (–0.333). The excluded variable from Model 1 were household size, shares of income from three sources (agriculture, rice and house rent) and change in share of income from rice, which were not statistically significant.

Similarly, in 2005, the positive determinants of growth in household income were household size, land area, share of agricultural income, and three difference variables including change in share of business-commerce income, change in share of house rent income and change in share of income from other sources. Amongst them, change in share of income from house rent was the largest positive contributor to growth with a regression coefficient of 0.269 followed by change in share of income from business-commerce (0.231) and share of income from rice (0.180). Conversely, the negative determinants included shares of income from four sources including wage-salary, house rent, gift-remittance-assistance and other sources, and changes in share of rice income in the same year. The largest negative determinant of growth was change in share of income from rice with a regression coefficient of –0.255 followed by share of income from wage-salary (–0.163) and share of income from gift-remittance-assistance (–0.162). The excluded variable (not significant) from the model were net seller dummy, share of income from business-commerce, and three variables related to changes in share of income from agriculture, wage-salary and gift-remittance-assistance.

Comparing base year and current year endowments, household land area, changes in shares of income from business-commerce and house rent were the positive determinants in both years. Conversely, the negative determinants were shares of income from wage-salary, gift-remittance-assistance, and other sources in both years. Net seller dummy and change in share of income from agriculture were the positive determinants with the base year (1985-86) endowments but were not statistically significant with the current year (2005) endowments. Similarly, share of income from business-commerce and changes in shares of income from wage-salary and gift-remittance-assistance were the negative determinants with the base year endowments and were not statistically significant with the current year endowments. On the other hand, three variables including household size, share of agricultural income, and share of income from rice were positive determinants considering the current year endowments and were not statistically significant with the base year endowments. Similarly, share of income from house rent and change in share of income from rice were the negative determinants with the current year endowment but were not statistically significant with the base year endowments.

This study suggests that household land area had a greater contribution to growth in real income with the base year endowment than with the current year endowments. Conversely, shares of income from agriculture and rice had positive and significant impact on growth with current year endowment but were not statistically significant with the base year endowment, suggesting a positive impact of agricultural trade liberalisation on growth in real income of rural households.

In Model 2, the regression coefficient for share of income from rice was positive (0.180) and statistically significant with the current year endowment. However, the regression coefficient of change in share of rice income was negative (–0.255) and statistically significant. This study suggests that current household endowments for the share of rice income was conducive to growth in household income but changes in the household endowments (between 1985-86 and 2005) for determining changes in the share of rice income impacted income growth negatively. This is an indication that the reallocation of resources (change in endowment) in favour of rice production was not efficient, implying that this resource could contribute to higher income growth of rural households if it were employed other than in rice production. This argument is consistent with observed facts that a higher volume of rice production generated excess supply over domestic demand for rice (restrictions on rice exports), resulting in a decrease in the producer price of rice leading to a decline in real income of farm households.

Table 7.7: Determinants of real income growth: 1985-86 to 2005

(**Dependent variable:** Growth in Income *(Log income 2005 – Log income 1985-86))*

Independent variables	Model 1 (1985-86)	Model 2 (2005)
	Regression Coefficients	
Household size	excluded, not significant	0.166 (.012)**
Household land area	0.369 (.004)***	.076 (.004)**
Net seller dummy	0.085 (.004)***	excluded, not significant
Share of agricultural income	excluded, not significant	0.164 (.204)***
Share of rice income	excluded, not significant	.180 (.038)***
Share of wage-salary income	-.486 (.277)***	-.163 (.129)***
Share of business and commerce income	-0.162 (.450)***	excluded, not significant
Share of house rent income	excluded, not significant	-.147 (.987)*
Share of gift, remittance and assistance income	-.190 (.380)***	-0.162 (.137)***
Share of other source income	-0.333 (.234)***	-0.197 (.231)***
Difference Variables		
Change in share of agricultural income	0.118 (.170)***	excluded, not significant
Change in share of rice income	excluded, not significant	-.255 (.033)***
Changes in share of wage-salary income	-.079 (.111)***	excluded, not significant
Change in share of business-commerce income	0.081 (.226)*	0.231 (.214)***
Change in share of house rent income	0.078 (.286)***	.269 (.892)***
Change in share of gift-remittance-assistance income	-.194 (.125)***	excluded, not significant
Change in share of other income	-0.203 (.097)***	.083 (.175)*
	R-square: 0.978	**R-square: 0.963**
	df1: 12; df2: 83	**df1: 12; df2: 83**
	F: 165.865; P-value: .000	**F: 125.263; P-value: .000**

Note: Model 1 represents base year's (1985-86) household endowments and Model 2 represents current year's (2005) endowments

excluded variables are not statistically significant

figures in brackets are standard errors.

* significant at 10%; ** significant at 5%; and *** significant at 1% level

7.3.2 Consumption Growth and Household Welfare

Household consumption is an important aspect for analysing welfare of rural households. It represents households' standard of living directly. It is a direct measure of household welfare. The patterns of household consumption and its determinants and growth are important aspects to consider for the analysis of household welfare.

7.3.2.1 Patterns of Household Consumption

Table 7.8 presents the descriptive statistics of household consumptions. As in the case of household income, the standard deviations of household consumption were large for all groups of rural households, suggesting a large dispersion of data from the mean indicating large variations in consumption of each group and across groups of rural households.

Table 7.8: Descriptive Statistics: household consumption by household types, 1985-86-2005

Household type	1985-86		2005	
	Mean	Std. Deviation	Mean	Std. Deviation
All rural households	2168.18	1498.52	5538.14	4898.83
Farm household	2499.00	1635.69	5891.01	5527.41
Non-farm household	1358.24	542.19	4630.75	2543.11
Large farmer	6907.80	2054.82	25286.50	18033.34
Medium farmer	3919.36	566.69	9048.33	4901.15
Small farmer	2129.65	471.73	4774.95	2055.32
Agricultural labourer	1108.82	309.60	2758.64	1109.19

Source: Author's calculation using data from BBS HHES 1985-86 and HHIES 2005

The patterns of household consumption as shown in Table 7.9 suggest that the distribution of consumption by food and non-food shares remained very similar over the period between 1985-86 and 2005. In 1985-86 and 2005, the mean food consumption for all deciles of rural households was 68 and 63 percent respectively; and the mean non-food consumption for all deciles was 32 and 37 percent of total consumption respectively in the same years. The shares of food and non-food consumption for households belonging to the bottom nine deciles – from Decile 1 to Decile 9 – were very close to average consumption of food and non-food items for all rural households in both 1985-86 and 2005. Compared to other deciles of households, it is clear that in 1985-86 and 2005 the households of Decile 10 had a much lower average share of food consumption with 59 and 46 percent and a much higher average share of non-food consumption with 41 and 54 percent respectively. These data suggest that households in Decile 1 to Decile 9 are relatively poor and need to spend a larger share of their income on food than non-food consumption. On the other hand, households in Decile 10 are relatively rich households in rural communities and they spend a smaller proportion of their income on food consumption compared to their non-food consumption expenditure. This analysis supported the argument that households included in the top decile of rural communities belonged to the highest income group and were distinctly different in terms of income and consumption from households of other deciles.

Rice is the single major component of food consumption for all groups of rural households. The average share of rice consumption in 1985-86 and 2005 were 45 and 44 percent of total food consumption respectively. Similarly, the share of other food consumption was 55 and 56 percent in 1985-86 and 2005 respectively. It is evident that the shares of rice and other food consumption were fairly distributed around their respective mean values, suggesting that the distribution of food consumption for all deciles of rural households was normal and followed a similar trend during 1985-86 to 2005. As we moved from Decile 1 to Decile 10, the share of rice consumption slowly decreased and the share of other food consumption slowly increased. This is a clear indication that poor households spent a larger share of their food expenditure on rice than that of rich households.

Table 7.9: Patterns of household consumption expenditure by deciles: 1985-86 to 2005

Deciles	All consumption				Food consumption			
	Food		Non-food		Rice		Other food	
	1985-86	2005	1985-86	2005	1985-86	2005	1985-86	2005
Decile 1	68	68	32	32	54	52	46	48
Decile 2	70	68	30	32	52	51	48	49
Decile 3	70	67	30	33	50	48	50	52
Decile 4	70	67	30	33	47	47	53	53
Decile 5	70	66	30	34	46	45	54	55
Decile 6	70	65	30	35	43	43	57	57
Decile 7	68	64	32	36	43	42	57	58
Decile 8	67	61	33	39	41	39	59	61
Decile 9	65	57	35	43	39	36	61	64
Decile 10	59	46	41	54	32	37	68	63
All HH (mean)*	**68**	**63**	**32**	**37**	**45**	**44**	**55**	**56**

Note: * all rural household (mean)
Source: Author's calculation using data from BBS HHES 1985-86 and HHIES 2005

7.3.2.2 Elasticity of Household Consumption

The above static patterns of consumption analysis support the hypothesis that the majority of rural households spent their consumption share of income on both essential food and non-food items for fulfilling their basic needs. This argument suggests that the elasticity of demand for consumption by rural households is considered to be less sensitive (inelastic) with respect to changes in households' income. The study estimated the elasticity of household consumption with respect to household income to analyse household consumption responsiveness to income change. It estimated the elasticity coefficients of household consumption using both univariate (with respect to income) and multivariate (with respect to all sources of income) regression models separately for analysing the functional relationship between household consumption and income. The study applied the Two-stage Least Square regression technique using instrumental variables to avoid endogeneity problems associated with endogenous relationship between income and consumption. The multivariate model aimed at tracing the impact of the share of a particular source of income (such as agriculture, rice etc.) on household consumption.

The estimated elasticity coefficient of household consumption with respect to income was 0.959, which was almost close to one as shown in Table 7.10. This result suggests that household consumption demand was close to unitary elastic indicating that an increase in one unit of income would be spent almost entirely on household consumption. Alternatively, the household consumption would respond to a change in income by almost the same amount of income change, suggesting that household consumption was essentially for survival (not for luxury goods). This is an indication that household consumption was approximately close to household expenditure.

Table 7.10: Elasticity of household consumption with respect to income 2010
(Dependent variable: Logarithm of household consumption)

Independent variables	Elasticity Coefficient
(constant)	1.352 (.675)***
Logarithm of household income	.959 (.078)***
R-square: .653; df1: 1, df2: 58; F: 5878.94 (P-value: .000)	

Note: instrumental variable: household head's literacy (human capital) dummy variable that could have impact on household income but might have no impact on consumption.

Figures in brackets are standard errors; and *** significant at 1% level

Considering the elasticity of household consumption with respect to income sources, all coefficients were smaller than one (inelastic) and positive, suggesting a positive relationship between consumption and income components as shown in Table 7.11. Amongst the income components, the largest elasticity of consumption coefficient was associated with agricultural income (0.605) followed by income from business-commerce (0.184). Similarly, the elasticities of income from gift-remittance-assistance and other sources were 0.070 and 0.103 respectively in the same year. This study suggests that agricultural income had the largest influence on household consumption in 2005.

Table 7.11: Elasticity of household consumption by income sources 2005

(**Dependent variable**: Logarithm of household consumption)

Independent variables	Elasticity Coefficients
Logarithm of income from agriculture	.605 (.030)***
Logarithm of income from business-commerce	.184 (.036)***
Logarithm of income from gift-remittance-assistance	.070 (.022)***
Logarithm of income from other-sources	.103 (.049)***
R-square: 0.939; df1: 4, df2: 84; F: 2871.480; P-value: .000	

Note: to avoid endogeneity problems, I used respective percentage shares of income of each source as instrumental variables that are related to income but not necessarily related to consumption. Similarly, to avoid multicollinearity problems, I excluded income from sources of wage-salary and house-rent, as they were not statistically insignificant.
Figures in brackets are standard errors; *** significant at 1%, level

7.3.2.3 Growth in Household Real Consumption by Quintiles

The growth in real consumption during 1985-86 to 2005 was fairly distributed across all groups of rural households and across all quintiles of each household group as shown in Table 7.12. All groups experienced a high average growth rate of annual consumption during this period. Amongst all groups of households, medium and large farmers experienced the highest average growth rate in consumption with an average of 3.07 percent followed by net sellers with an average of 2.82 percent per year during 1985-86 to 2005. Interestingly, medium and large farmers are mainly net sellers of rice in rural areas. Comparing farm and non-farm households, farm households enjoyed slightly higher consumption growth than non-farm households. Small farmers and agricultural labourers are the poor households in the rural economy and these two groups experienced lower average growth in consumption than rural households as a group, suggesting that like household income growth, the growth in consumption was also not pro-poor during 1985-86 to 2005. This argument was reinforced by the fact that the average pro-poor growth rate of consumption for each group of households was smaller than its corresponding average growth rate of consumption in mean. This proposition was true for all groups of rural households. Considering growth by quintiles, all groups of households experienced very similar patterns of growth in consumption across quintiles indicating that agricultural trade liberalisation influenced household consumption positively in terms of distribution of consumption.

Table 7.12: Average growth in real consumption: 1985-86 to 2005
(in percent)

Household Type	Average quintile growth rate					Rate of Pro-poor Growth (mean of quintile growth rates)	Growth rate in mean
	Q1	Q2	Q3	Q4	Q5		
All rural household	2.38	2.35	2.37	2.56	2.99	2.53	2.74
Non-farm household	2.15	2.61	2.29	2.34	2.44	2.37	2.55
Farm household	2.34	2.37	2.47	2.75	3.04	2.60	2.80
Agricultural labourer	2.38	2.34	2.36	2.40	2.44	2.38	2.41
Small farmer	2.37	2.31	2.48	2.59	2.87	2.52	2.55
Medium and large farmer	2.56	2.83	2.77	2.70	3.97	2.96	3.07
Net seller	2.29	2.35	2.39	2.68	3.05	2.55	2.82
Net buyer	2.50	2.29	2.38	2.43	2.76	2.47	2.53

Source: Author's calculation using data from BBS HHES 1985-86 and HHIES 2005

7.3.2.4 Determinants of Household Consumption

The determinants of household consumption were analysed based on household characteristics. Like the analysis of income determinants, the same approaches were followed in specifying consumption determinants with three OLS regression models.

This model allowed both economic and non-economic characteristics of households to interact simultaneously for determining household consumption in 2010. The study considered household size, household head's literacy, household land area, rice price and some dummy variables – non-farm household, rice mostly bought in peak season, access to desired market, and environmental impact as explanatory variables in this model. However, household size and household head's literacy were found not statistically significant, thereby excluded from the model. Similarly, the study used an environmental dummy variable to investigate as to whether environmental impacts from agricultural trade liberalisation influenced consumption of rural households. However, this variable also was not statistically significant, thereby excluded from this model.

As shown in Table 7.13, the positive determinants of household consumption were household land area and two dummy variables – non-farm household and access to most desired market to buy rice in 2010. Amongst the positive determinants, non-farm household dummy was the largest contributor to household consumption with a regression coefficient of 0.505 followed by household land area (0.489) and access to desired market to buy rice (0.129). Conversely, the negative determinants were rice price and two dummy variables – net buyer and rice mostly bought on peak season in the same year. Amongst the negative determinates, net buyer dummy variable had the largest negative influence on consumption with a regression coefficient of –0.293 followed by rice price (–0.244) and rice mostly bought on peak season (–0.186).

Table 7.13: Determinants (related to rice) of household consumption 2010
(**Dependent variable:** Logarithm of household consumption expenditure)

Independent variables	Regression Coefficients
Household land area	.489
	(.026)***
Non-farm household dummy	.505
	(.137)***
Net buyer of rice dummy	-.294
	(.111)***
Rice mostly bought in peak	-.186
season dummy	(.115)**
Access to most desired market to	.130
buy rice dummy	(.107)*
Logarithm of rice price	-.244
	(.130)***
R-square: 0.788; df1: 6, df2: 53; F: 32.837, P-value: 0.000	

Note: Calculated from data of Household Survey 2010 conducted by the author

Figures in brackets are standard errors; * significant at 10%; ** significant at 5%; and *** significant at 1% level

7.3.2.5 Determinants of Household Consumption Growth and Welfare

As discussed in 7.3.2.3, all groups of rural households experienced considerable growth in consumption during 1985-86 and 2005. Two separate regression models were carried out to identify the determinants and sources of household consumption growth. Both models – Model 1 and Model 2 – included economic and non-economic characteristics of rural households, difference variables (changes in the shares of income from different sources), and three major components of household consumption (food, non-food, and rice). Model 1 considered the base year's (1985-86) data – initial endowments of households. Similarly, Model 2 considered the current year's (2005) data – current endowments of households. Difference-variables were changes in shares of household income by sources. They captured the changes in household endowments during 1985-86 to 2005. The results of these models were presented in Table 7.14.

Non-economic characteristics of household considered in the OLS models were household size, and household head's age, gender and education. However, these explanatory variables were not statistically significant, thereby excluded from both models. This evidence suggests that household non-economic characteristics were not important in determining the growth in consumption of rural household between 1985-86 and 2005.

In 1985-86, the positive determinants of growth in household consumption were household land area, three difference variables (changes in shares of income from agriculture, business-commerce, and house rent) and food consumption. Amongst these determinants, food consumption was the largest contributor to the growth with a regression coefficient of 2.346 followed by household land area (1.294) and change in share of income from business-commerce (0.399) in the same year. Conversely, the negative determinants were net buyer dummy, share of income from five sources (wage-salary, business-commerce, house rent, gift-remittance-assistance, and other sources), two change variables (changes in shares of income from gift-remittance-assistance and other sources), and two consumption components (non-food and rice consumption). Amongst the negative determinants, rice consumption had the largest negative impact on growth with a regression coefficient of –2.782 followed by non-food consumption (–1.870) and share of income from other sources (–0.780). Considering household characteristics, household land area was the sole positive determinant of household consumption growth in 1985-86. Conversely, net seller dummy and shares of income from five sources including wage-salary, business-commerce, house rent, gift-remittance-assistance and other sources were the negative determinants of growth in consumption in the same year. Amongst the difference variables, change in the shares of income from agriculture, business-commerce and house rent had positive impact and changes in shares of income from gift-remittance-assistance and other sources had negative impact on household consumption growth. Amongst the three consumption components, food consumption had positive impact and non-food consumption and rice consumption had negative impact on growth. The excluded variables in Model 1 were landless dummy, share of agricultural income and change in share of wage-salary income, which were not statistically significant. It is evident from the above analysis that it was not rice consumption, but farm household characteristics related to rice income such as land, and change in share of agricultural income positively contributed to growth in household consumption in 1985-86.

Similarly, in 2005, the positive determinants of growth in household consumption were landless dummy, share of income from wage-salary, change in share of income from four sources (agriculture, business-commerce, house rent and other sources) and two consumption components (non-food and rice consumption). Amongst these determinants, rice consumption was the largest contributor to the growth with a regression coefficient of 2.594 followed by non-food consumption (1.494) and change in share of house rent (1.155). Conversely, the negative determinants of growth were household land area, share of income from four sources (agriculture, business–commerce, house rent, and other sources), change in share of gift-remittance-assistance and food consumption in 2005. Amongst the negative determinants, food consumption had the largest negative impact on growth in household consumption with a regression coefficient of –3.588 followed by share of income from business–commence (–0.919) and share of income from house rent (–0.910) in the same year. Amongst household characteristics, household landless dummy and share of income from wage-salary were the positive determinants of growth in household consumption in 2005. Conversely, household land area and shares of income from four sources including agriculture, business-commerce, house rent, and other sources were the negative determinants of growth in the same year. Considering the difference variables, changes in share of income from agriculture, business-commerce, house rent, and other sources had positive impact and change in share of income from gift-remittance-assistance had negative impact on growth in 2005. The excluded variable in Model 2 were net buyer dummy, share of income from gift-remittance-assistance and change in share of wage-salary, which were not statistically significant.

Considering both models, three difference variables – change in share of income from agriculture, business-commerce, and house rent – had positive impact on growth in household consumption in both 1985-86 and 2005. Conversely, shares of three sources of income (business-commerce, house rent and other sources) and changes in share of gift-remittance-assistance were the negative determinants of growth in both years. Although household land area and food consumption were positive determinants in 1985-86, they were negative determinants of growth in 2005. Similarly, share of income from wage-salary, change in share of income from other sources, and two consumption components (non-food and rice) were the positive determinants in 2005 but they were the negative determinants in 1985-86. Net buyer dummy and share of income from gift-remittance-assistant had negative impact on consumption growth in 1985-86 but they were not statistically significant in 2005. Similarly, landless dummy had positive impact and share of agricultural income had negative impact on growth in 2005 but they were not statistically significant in 1985-86.

As discussed earlier, rice consumption was the largest positive contributor to growth in household consumption followed by non-food consumption in 2005, suggesting that agricultural trade liberalisation contributed to an increase in rice production and consumption, leading to higher growth in household consumption. On the other hand, food consumption had the largest negative impact on growth in consumption followed by share of business-commerce income, implying that the non-food component, rather than the food component as a whole, contributed to higher consumption growth. This analysis suggests that as income grew, households were more likely to spend greater shares of income on non-food consumption than on food consumption, which was evident in the post-liberalisation era. This analysis supported the explanation in sub-section 7.3.2.1 that as we moved from Decile 1 to Decile 10, food expenditure decreased and non-food expenditure increased.

The share of income from rice and changes in share of income from rice were considered in both regression models but were not statistically significant, thereby excluded from the models. Although the change in the share of agricultural income was a positive contributor to consumption growth in both 1985-86 and 2005, neither the share of rice income nor the change in the share of rice income was statistically significant. This analysis suggests that it was not the rice income but income from other sources were responsible for the contribution to growth in household consumption in both 1985-86 2005.

Table 7.14: Household consumption growth: 1985-86 to 2005

Dependent variable: Growth in Consumption *(Log consumption 2005 – Log consumption 1985-86)*

Independent variables	Model-1 (1985-86)	Model-2 (2005)
Household land area	1.294 (.008)***	-.149 (.003)*
Landless dummy	excluded, not significant	.110 (.008)**
Net buyer dummy	-.313 (.010)***	excluded, not significant
Share of income from agriculture	excluded, not significant	-.334 (.220)*
Share of income from wage-salary	-.624 (.364)**	.201 (.112)*
Share of income from business-commerce	-.342 (.498)*	-.919 (.339)***
Share of income from house rent	-.182 (1.094)	-.910 (.824)***
Share of income from gift-remittance-assistance	-.367 (.382)***	excluded, not significant
Share of income from other source	-.780 (.288)***	-.475 (.267)***
Difference variables		
Change in share of agricultural income	.343 (.136)***	.544 (.187)***
Change in share of wage-salary income	excluded, not significant	excluded, not significant
Change in share of business-commerce income	.399 (.189)**	1.075 (.267)***
Change in share of house rent income	.110 (.185)*	1.155 (.808)***
Change in share of gift-remittance-assistance income	-.659 (.091)***	-.401 (.112)***
Change in share of other income	-.348 (.166)***	.494 (.113)***
Consumption components		
Log (food consumption)	2.346 (.183)*	-3.588 (.195)**
Log (non-food consumption)	-1.870 (.102)*	1.494 (.076)*
Log (rice consumption)	-2.782 (.146)***	2.594 (.143)***
	R-square: .849 **df1: 15, df2: 74** **F: 27.752; P: .000**	**R-square: .795** **df1: 15, df2: 76** **F: 19.689; P: .000**

Note: Model 1 represents base year's (1985-86) household endowments and Model 2 represents current year's (2005) endowments
excluded variables are not statistically significant.
figures in brackets are standard errors.
* significant at 10%; ** significant at 5%; and *** significant at 1% level

7.4 Conclusion

The above findings suggest that the growth in both household income and consumption were not pro-poor during 1985-86 to 2005. Although all rural households experienced moderate to high growth in real income and consumption, rich households gained more from agricultural trade liberalisation through higher real income and consumption than poor households. This suggests that agricultural trade liberalisation contributed to higher growth in the rural economy but it contributed to greater inequality in income distribution amongst the rich and poor income groups (quintiles), signifying that it might not have contributed to poverty reduction as much as it did to real income growth.

However, this chapter did not analyse how agricultural trade liberalisation influenced poverty and inequality, which requires further analysis. The following chapter, Chapter 8, analyses the impact of agricultural trade liberalisation on inequality and poverty reduction.

CHAPTER EIGHT

Agricultural Trade Liberalisation: Income Distribution, Inequality and Poverty

8.1 Introduction

Chapter Seven examined how changes in productivity and prices of rice influenced the welfare of rural households through a critical analysis of income and consumption. The results showed that rich households gained more than poor households, indicating that agricultural trade liberalisation was not pro-poor. However, in that chapter, no attempt was made to analyse the impact of agricultural trade liberalisation on the welfare of rural households through changes in poverty and inequality.

This chapter analyses the scenarios of income distribution, inequality, and poverty amongst rural households. It also analyses how income distribution changed during the post-liberalisation period 1985-86 to 2005. It investigates the trend of inequality amongst rural households to see if the changes brought about poverty reduction during that period.

8.2 Income Distribution and Inequality

8.2.1 Income Distribution

All groups of rural households experienced growth in income during the post-liberalisation era. However, the benefits of growth were not evenly distributed across the rural household groups – the rich received a higher share than the poor. Consequently, the income gap between the poor and the rich widened during the post-liberalisation period as shown in Table 8.1.

The pattern of household income distribution by deciles suggests that the richest group accumulated an increasingly higher share of income and the poorest group gradually received a lower share of income during 1985-86 through to 2005. Decile 1 represents the lowest (poorest) 10 percent and Decile 10 represents the highest (richest) 10 percent income group of rural households. As we moved from Decile 1 towards Decile 10, the relative share of income for respective deciles progressively increased, indicating that the poor received a smaller share and the rich received a larger share of income. It is evident from the table that the income gap between the poorest (bottom 5 percent) and the richest (top 5 percent) of rural households was extremely large both in 1985-86 and in 2005. In 1985-86, the bottom 5 percent of households accounted for only 1.10 percent of total income whereas top 5 percent captured 19.81 percent – over 18 times greater in absolute terms than that of the bottom 5 percent income group. This gap was widened over the course of time as found in 2005 – the bottom 5 percent of households received only 0.88 percent but the top 5 percent received 23.63 percent of total income.

The share of household income from Decile 1 to Decile 7 declined over 20 years. Therefore, household income of Decile 8 and Decile 9 remained almost unchanged during the same period. Conversely, household income of Decile 10 progressively improved over the same period. This is also evident from quintile analysis as presented in Table 8.2.

Table 8.1: Percentage share of income by deciles

Deciles	1985-86	1991-92	1995-96	2000	2005
Lowest 5%	1.10	1.07	1.00	1.07	0.88
Decile 1	2.74	2.67	2.55	2.28	2.25
Decile 2	4.13	4.07	3.93	4.31	3.63
Decile 3	5.10	5.10	4.97	5.25	4.54
Decile 4	6.05	6.05	5.97	5.95	5.42
Decile 5	7.21	7.21	6.98	6.84	6.43
Decile 6	8.25	8.57	8.16	7.88	7.63
Decile 7	9.69	10.28	9.75	9.09	9.27
Decile 8	11.74	12.30	11.87	10.97	11.49
Decile 9	15.10	15.71	15.58	14.04	15.43
Decile 10	30.08	28.04	30.23	32.81	33.92
Top 5%	19.81	17.80	19.73	23.52	23.63

Source: Compiled from BBS HHIES 2000 and HHIES 2005

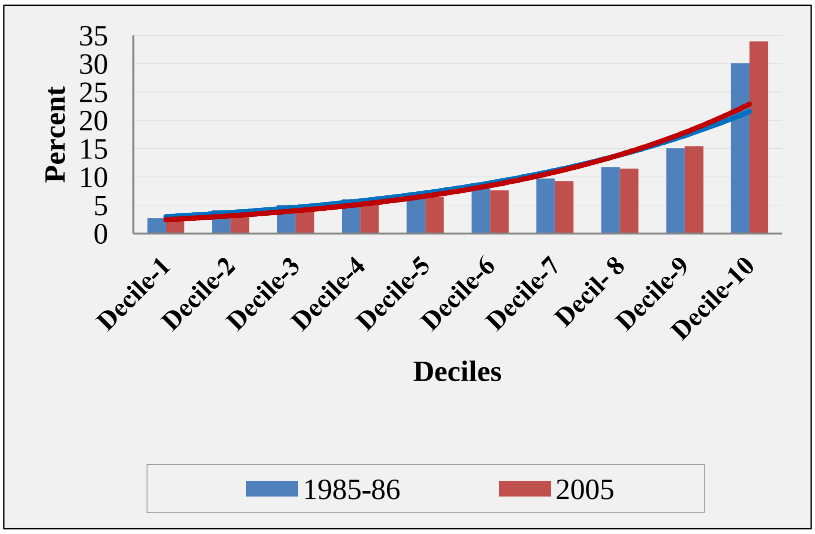
Table 8.2: Share of income by quintile: 1985-86 and 2005

Year	**Q-1** (poorest)	Q-2	Q-3	Q-4	**Q-5** (richest)
1985-86	6.85	11.13	15.44	21.41	45.16
2005	5.88	9.96	14.06	20.76	49.35

Source: Author's calculation from Table 8.1

Considering income distribution across deciles, the trend lines for both the initial year (1985-86) and the current year (2005) were quite similar, showing increasing inequality in income distribution as presented in Figure 8.1. Therefore, the upward trend in the percentage share of income from Decile 1 to Decile 10 showed a continued divergence in income gap between the poor and the rich. This trend suggests a greater inequality in income distribution when viewed from the bottom to the top of the distribution, even between any two closest deciles from Deciles 1 towards Decile 10.

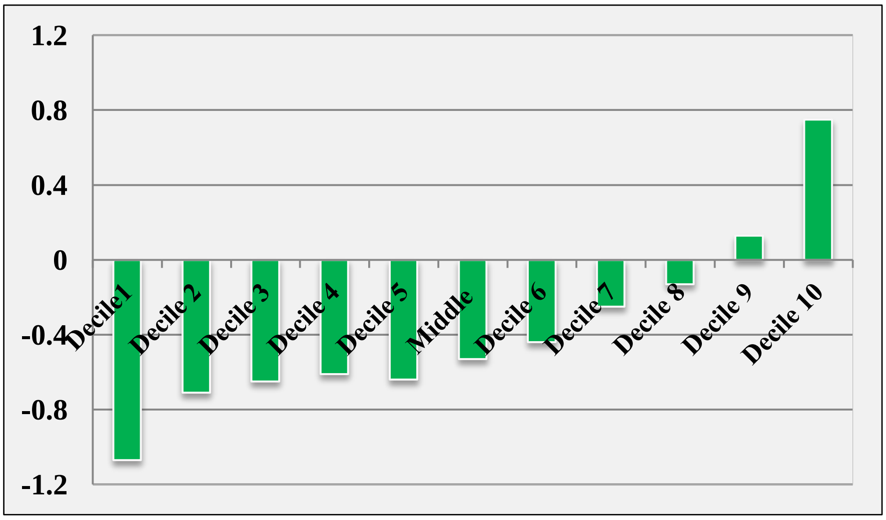
Figure 8.1: Distribution of income by deciles: 1988-89 and 2005



Source: Author's calculation from BBS HHES 1985-86 and HHIES 2005

As calculated from Table 8.1, the poorest 5 percent of households experienced a decrease in their share of income by an average of –1.18 percent per year over 1985-86 to 2005. Conversely, the richest 5 percent experienced an increase in their share of income by an average of 1.13 percent over the same period. The magnitude of these changes in the average share of annual income by deciles is presented in Figure 8.2. It is a clear indication that the distribution of income between the poor and the rich deteriorated gradually in the post-liberalisation era – the rich became richer, and the poor became poorer – suggesting an increase in inequality between poor and rich households in the rural areas. Interestingly, the bottom eight deciles (80 percent of bottom households) experienced a decrease in the percentage share of their respective income. This magnitude increased from Decile 8 towards Decile 1. On the other hand, the top two deciles (top 20 percent of households) experienced an increase in their respective share of income and Decile 10 received a greater increase in their share of income than that of Decile 9.

Figure 8.2: Changes in average percentage share of income by deciles: 1985-86 to 2005



Source: Author's calculation from BBS HHES 1985-86 and HHIES 2005

8.2.2 Inequality

The distribution of income scenario reveals the inequality over the entire population of rural households. The Gini coefficient is the most widely used single measure of inequality (Haughton and Khandker 2009: 104). It ranges from zero (perfect equality) to one (perfect inequality). As shown in Table 8.3, the Gini coefficient increased from 0.36 in 1985-86 to 0.42 in 2005, implying increased inequality in income distribution between the poorest and richest households during this period. The consistent increase in the Gini coefficient over the course of time suggests that the inequality in income distribution between the poor and the rich gradually became greater during 1985-86 to 2005. Thus, the Gini coefficient increased by an average of 0.98 percent per year during that period.

Table 8.3: Gini coefficients for household income distribution: 1985-86 to 2005

	1985-86	1991-92	1995-96	2000	2005	Average Change (%)
Gini coefficient	*0.36*	*0.36*	*0.38*	*0.39*	*0.42*	**0.98**

Note: Changes shown between years 1985-86 and 2005
Source: Compiled and calculated (bold) from HHES 1985-86 and HHIE 2005 of BBS

8.2.3 Inequality Decomposition

Generalised Entropy (GE) is another commonly used measure of inequality. The values of GE vary from zero (0) to infinity (∞), with zero representing an equal distribution and higher values representing higher levels of inequality. The parameter α in GE(α) represents the weight given to distances between incomes at different parts of the income distribution and can take any real value. However, the most common values of α used are 0, 1 and 2. GE(α=0) is sensitive to changes in the lowest tail, GE(α=1) is sensitive to changes in the middle part and GE(α=2) is sensitive to changes in the highest tail of the distribution (Haughton and Khandker, 2009: 106, 107).

As shown in Table 8.4, all rural households (as a group) experienced relatively high inequality in 2005 with higher values of corresponding GEs(α = 0, 1, 2) compared to those of 1985-86. As we moved from the lowest to highest tail of the distribution, inequality also increased with gradually higher values of GEs in both 1985-86 and 2005. It is evident from the table that the values of GE(α=2) are relatively large compared to the other two values of GEs in both years, suggesting that the largest inequality was present with the highest tail of the distribution of income of rural households in these years. The values of GEs the non-farm households were very small in both years, implying low inequality in the distribution of income amongst non-farm households. On the contrary, the values of GEs for farm households were very large in both years, indicating relatively high inequality in the distribution of income amongst farm households.

Each value of GE is decomposed into two inequality components: within-group and between-group inequality. The component "within-group inequality" represents variation of income inside each group of households and "between-group inequality" represents variation in income from one group to another group of households. The summed up value of within-group and between-group inequality represents the total value of respective GE (inequality) of the rural households.

As presented in Table 8.4, the results show that the inequality is mostly generated from within-group component and not from between-group inequality in both years because of very high inequality within the farm households.

Table 8.4: Decomposition of inequality by farm and non-farm households

	1985-86			**2005**		
	GE(α=0)	**GE(α=1)**	**GE(α=2)**	**GE(α=0)**	**GE(α=1)**	**GE(α=2)**
All Rural household	**25.6**	**51.1**	**201.7**	**38.4**	**80.1**	**401.7**
Household Type						
Non-farm household	1.6	1.5	1.5	9.4	14.0	26.0
Farm household	31.9	60.3	218.2	48.0	95.9	449.5
Within-group inequality	22.9	48.6	199.4	36.4	78.3	400.0
Between-group inequality	2.7	2.5	2.3	2.0	1.9	1.8
Within as a share of total	**89.4**	**95.1**	**98.9**	**94.8**	**97.7**	**99.6**
Between as a share of total	**10.6**	**4.9**	**1.1**	**5.2**	**2.3**	**0.4**

Source: Author's calculation using data from BBS HHES 1985-86 and HHIES 2005

Further decomposition of inequality by types of rural households is presented in Table 8.5. Amongst all groups of rural households, medium farmers experienced the highest inequality for all cases of GEs in both 1985-86 and 2005. The magnitude of inequality with medium farmers was very similar across GEs in 1985-86 but the trend in inequality increased significantly from GE (α=0) to GE (α=2) in 2005. Noticeably, inequality amongst the highest tail of the distribution of medium farmers is the largest with a GE value of 344.5 compared to either the lowest tail or the medium part of the distribution. Interestingly, the GE values for large farmers were very similar and not large across GEs in 1985-86 as well as in 2005, indicating a similar pattern of income distribution from the lowest to the highest tail of the distribution of large farmers during this period. Like those for non-farm households, the values of GEs for small farmers and agricultural labourers were very small in both 1985-86 and 2005, indicating low inequality in income distribution amongst these groups of households. Noticeably, in 2005, the value of GE(α=0) for large farmers (closest tail to medium farmers) was the highest (20.5) and the value of GE(α=2) for small farmers (closest tail to medium farmers) was the largest (11.1) suggesting that the source of inequality amongst rural households is generated mainly from inequality of medium-farmer households.

This situation may be attributed to increased productivity of rice and the selling-buying behaviours of medium farmers. The benefit from increased productivity was not distributed equally amongst medium farmers because of differences in their involvement with rice markets. As revealed in the HHE 2010, all medium farmer households were net sellers – 14.29 percent sold rice during the lean season and 85.71 percent sold rice during both lean and peak seasons but mostly in the lean season. Those who sold rice during the peak season received a much lower price than those who sold in the lean season, suggesting a large difference in income from the same amount of rice sold, resulting in large inequality amongst medium farmer households.

All groups of rural households experienced a relative increase in the values of GEs in 2005 compared to those in 1985-86, indicating that the increase in productivity of rice and reduction in rice prices resulting from agricultural trade liberalisation contributed to a higher inequality in income distribution in the rural economy of Bangladesh in the post-liberalisation period.

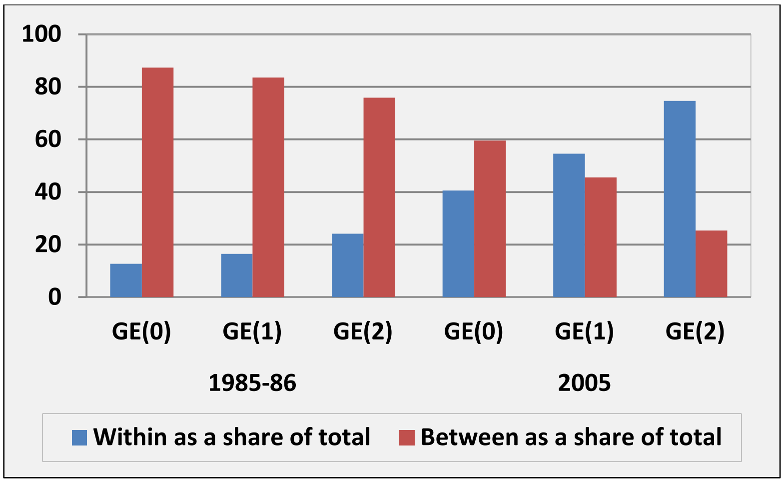
Table 8.5: Decomposition of inequality by household types

	1985-86			**2005**		
Household type	**GE(α=0)**	**GE(α=1)**	**GE(α=2)**	**GE(α=0)**	**GE(α=1)**	**GE(α=2)**
All rural household	25.6	51.1	201.7	38.4	80.1	401.7
Large farmer	7.3	7.4	7.9	20.5	14.7	11.7
Medium farmer	34.6	34.8	41.6	77.2	113.2	344.5
Small farmer	1.0	1.0	1.0	4.7	6.8	11.8
Agricultural labourer	0.5	0.5	0.5	2.0	1.8	1.7
Non-farm household	1.6	1.5	1.5	9.4	14.0	26.0
Within-group inequality	3.2	8.4	48.5	15.6	43.7	299.9
Between-group inequality	22.4	42.7	153.1	22.8	36.4	101.9

Source: Author’s calculation using data from BBS HHES 1985-86 and HHIES 2005

As shown in Figure 8.3, initially in 1985-86 shares of between-group inequality across GEs were much larger than those of within-group inequality. This was reversed in 2005, with larger shares of GEs of within-group inequality. This scenario suggests that the rural inequality was generated largely from within-group inequality in the post-liberalisation period.

Figure 8.3: Within-group and between-group as a share of total inequality by household types: 1985-86 to 2005



Source: Author's calculation based on Table 8.4

A significant inequality in income distribution across groups of rural households contributed to low reduction in poverty during 1985-86 to 2005. The poor gained less but the rich received most of the benefit from agricultural trade liberalisation, thus leaving a high level of poverty during this period as analysed in the following section.

8.3 Poverty in Rural Bangladesh

The conventional view of poverty is the pronounced deprivation in well-being. It is measured by comparing individual or household income or consumption with some defined threshold below which they are considered poor. In this case, poverty is largely seen in monetary terms – and is the starting point for most analyses of poverty. Sen (1987) argued that well-being would come from a capability function in society. Thus, poverty arises when people lack key capabilities, and so they have inadequate income or education, or poor health, or insecurity, or low self-confidence, or a sense of powerlessness, or the absence of rights such as freedom of speech (Haughton and Khandker, 2009: 3). This study measured and considered poverty by comparing household consumption with poverty lines defined and estimated by the Bangladesh Bureau of Statistics (BBS) based on various household surveys.

8.3.1 Overall Rural Poverty in Bangladesh

8.3.1.1 Head Count Index of Poverty

Despite agricultural trade liberalisation improving productivity of rice and all groups of rural communities experiencing positive growth in income over two decades – 1985-86 to 2005 – the distribution of income was uneven. Thus, the reduction in rural poverty was insignificant over this period. Table 9.6 shows the headcount rate of poverty that provided the pictures of rural poverty during 1985-86 to 2005 in Bangladesh.

The headcount index is the most widely used measure of poverty. It calculates the proportion of the population with a standard of living below the poverty line that is counted as poor (Haughton and Khandker, 2009: 69; Ravallion and Huppi, 1991: 60). The main strength of the headcount index is that it is simple to construct and easy to understand (Haughton and Khandker, 2009: 69). As estimated by the Bangladesh Bureau of Statistics (BBS) in HHES 1985-86 and HHIES 2005, this study followed the same values of the upper and lower poverty lines to calculate the headcount index of poverty of rural households. The lower poverty line represents food and non-food consumption expenditure that is equal to food expenditure (food poverty line) corresponding to meeting minimal nutritional requirements, 2122 kilocalories per capita per day. It corresponds to the extremely poor households whose total expenditure on food and non-food is equal to the food poverty line. Therefore, the lower poverty line represents smaller food intake than 2122 kilocalories. On the other hand, the upper poverty line represents food consumption expenditure with a value equal to the food poverty line plus a typical non-food consumption expenditure which is close to the food poverty line (BBS, 2007b: 155, 156). Therefore, the upper poverty line corresponds to the moderately poor households.

In 1985-86, considering the upper poverty line, 65.5 percent of the population lived in poverty (64.96 million) and this figure in 2005 was 44.9 percent of the total population (59.36 million) (Table 8.6). Considering the headcount rate of poverty and the absolute number of poor population, a large number of the rural population lived in poverty during this period, albeit decreasing by about five million between 1985-86 and 2005.

Table 8.6: Poverty in rural areas of Bangladesh: 1985-86 to 2005

	Headcount Index					
Poverty lines	**1985-86**	**1988-89**	**1991-92**	**1995-96**	**2000**	**2005**
Upper poverty line	65.2	62.5	58.7	54.5	52.3	44.9
Lower poverty line	47.0	44.6	43.7	39.4	37.9	27.3

Source: Compiled from BBS for the respective years household surveys

Although the trend of poverty was declining, progress was slow with a large variation in poverty reduction across different groups of rural households. As shown in Table 8.7, the reduction in poverty across different groups of rural households was not even – some groups experienced a larger reduction rate than others. Considering both the upper and lower poverty lines, non-farm households experienced the largest reduction in poverty for the period 1985-86 to 2005. On the contrary, farm households experienced the lowest rate of poverty reduction – far below that of non-farm households. This fact reinforced the argument that non-farm households are net buyers of rice and they benefited most from a decrease in the consumer price of rice as a result of agricultural trade liberalisation. In addition, agricultural trade liberalisation facilitated growth in the non-farm sector with a greater opportunity for employment and higher wages in the non-farm sector that contributed to a larger reduction in poverty than that of the farm sector. Although agricultural trade liberalisation improved productivity of rice, farmers experienced a large decrease in the producer price, thus reducing their welfare. This fact is reflected again through the lower rate of poverty reduction in the group of farm households than that of other groups of rural communities.

Table 8.7: Change in overall poverty by household groups: 1985-86 to 2005

	Headcount rate			
	1985-86	**2005**	**Total change**	**Average change**
Upper poverty line				
Rural household	65.2	44.9	-20.3	**-0.97**
Non-farm household	80.1	48.8	-31.3	**-1.49**
Farm household	58.8	43.2	-15.7	**-0.75**
Lower poverty line				
Rural household	47.0	27.3	-19.6	**-0.93**
Non-farm household	68.5	21.4	-47.1	**-2.24**
Farm household	37.9	29.9	-8.0	**-0.38**

Note: Changes shown between years 1985-86 and 2005

Source: Author's calculation using data from BBS HHES 1985-86 and HHIES 2005

As revealed in the above analysis, the headcount index can explain only the overall situation of poverty but cannot expound the intensity of poverty because as a welfare function it does not take into account the intensity of poverty. This implies that the headcount index does not illustrate how poor the poor are; hence, it does not change if people below poverty line became poorer or improve their poverty conditions in terms of relative intensity. Therefore, the poverty gap index is required to analyse the intensity of poverty below the poverty lines.

8.3.1.2 Poverty Gap Index

The poverty gap index measures changes in the degree of poverty amongst the poor. It explains the extent to which individuals on an average fall below the poverty line and expresses it as a percentage of the poverty line (Haughton and Khandker, 2009: 70; Ravallion and Huppi, 1991: 61). It defines the gap as the poverty line less the actual income of poor individuals. Thus, the poverty gap is to be considered zero for non-poor individuals. It measures the mean proportionate distance of poverty gap in the population. This is a useful measure to analyse the intensity of poverty. The larger the values of this index the bigger the intensity of poverty because the average gap is greater between the poverty line and actual income of the poor.

As shown in Table 8.8, considering both the upper and lower poverty lines, the poverty gap index for non-farm households was much higher than that of farm households – even higher than that of the rural household group as a whole in 1985-86, suggesting the intensity of poverty within the non-farm household group was larger than that of farm households. However, this index for non-farm households became smaller than that of either farm or rural households, suggesting that the non-farm households experienced a higher reduction in poverty and a lower intensity in the average poverty gap in the post-liberalisation period. They experienced a greater reduction in poverty gap by –14.0 percent over that period, indicating that the difference between poor households' average consumption and the poverty line decreased. Considering both the upper and lower poverty lines, the poverty gap indices for all groups of rural households were lower in 2005 compared to their respective indices in 1985-86. This is a clear indication that the intensity of rural poverty became lower in the post-liberalisation period, suggesting that agricultural trade liberalisation had a positive impact on lowering average poverty gaps – the differences between poverty lines and average consumption of the poor.

Table 8.8: Overall poverty: poverty gap

	1985-86	2005	Change
Upper poverty line			
Rural household	14.7	6.9	-7.7
Non-farm household	20.1	6.1	-14.0
Farm household	12.4	7.3	-5.1
Lower poverty line			
Rural household	4.8	2.2	-2.5
Non-farm household	7.9	1.8	-6.1
Farm household	3.4	2.4	-1.0

Note: Changes shown between years 1985-86 and 2005
Source: Author's calculation using data from BBS HHES 1985-86 and HHIES 2005

The poverty gap index is weight-neutral – giving the same weight irrespective of the distance of household consumption from the poverty line. Thus, it cannot measure the severity of poverty within a group of poor households and so the squared poverty gap index is analysed below to address this issue.

8.3.1.3 Squared Poverty Gap Index

The squared poverty gap index is a measure of poverty to compute and compare the severity of poverty. This is simply a weighted sum of poverty gaps as a proportion of the poverty line, where the weights are the proportionate poverty gaps themselves. Hence, by squaring the poverty gap index, it simply puts more weight on observations that fall well below the poverty line (Haughton and Khandker, 2009: 70; Ravallion and Huppi, 1991: 61). Like the poverty gap index, the larger the value of the squared poverty gap index, the greater is the severity of poverty. As shown in Table 8.9, non-farm households experienced the largest value of the squared poverty gap index considering both upper and lower poverty lines with 5.8 and 1.6 percent respectively in 1985-86. However, they experienced the least severity in poverty with the lowest squared poverty gap indices in 2005.

Table 8.9: Overall poverty: squared poverty gap (percent)

	1985-86	2005	Change
Upper poverty line			
Rural household	3.8	1.6	-2.1
Non-farm household	5.8	1.3	-4.4
Farm household	2.9	1.8	-1.2
Lower poverty line			
Rural household	0.9	0.5	-0.4
Non-farm household	1.6	0.4	-1.3
Farm household	0.5	0.6	0.0

Note: Changes shown between years 1985-86 and 2005

Source: Author's calculation using data from BBS HHES 1985-86 and HHIES 2005

Considering three important measures of poverty (headcount rate, poverty gap, and squared poverty gap index) the performance of non-farm households in poverty reduction was much greater than that of farm household in the post-liberalisation period. This analysis has reinforced the argument that the non-farm households gained more from agricultural trade liberalisation than farm households.

8.3.1.4 Poverty by Household Types

Although rural poverty decreased as per headcount indices, the magnitude of change is not similar for all groups of rural households as shown in Table 8.10. By dividing rural households into two main groups – farm and non-farm households, the proportional distribution of poor population suggests that farm households experienced an increase in poor population by 3.7 percent, while non-farm households experienced a corresponding decrease in poor population by 3.7 percent. Amongst different groups of farm households, large and medium farmers did not have a poor population during 1985-86 to 2005, as they were considered rich households in the rural communities. Considering both upper and lower poverty lines, small farmers experienced lower reduction in poverty than the agricultural labourers during that period. However, considering the upper poverty line, small farmers experienced an actual reduction in poor population by –13.8 percent but agricultural labourers experienced an increase in poor population by 17.6 percent over the same period. Similarly, considering the lower poverty line, small farmers experienced a reduction in poor population by –9.8 percent but agricultural labourers experienced an increase in poor population by 29.6 percent during that period. Therefore, amongst the farm households the incidence of poverty increasingly fell on agricultural labourers, thereby increasing their poor population from 23.0 percent in 1985-86 to 40.6 percent in 2005 with the upper poverty line and from 30.1 percent in 1985-86 to 59.7 percent in 2005 with the lower poverty line. This result suggests that agricultural labourers experienced the largest increase in poor population in the post-liberalisation period.

The reasons might be because of a) either inter-group transfer from small farmers to agricultural labourers through distress sales of land by poor small farmers due to crop failures resulting from natural calamities such as floods, cyclones, droughts; or/and b) demographic change whereby the number of poor labourers was swollen by young poor entering adulthood poor and moving into agricultural labourer group. A longitudinal study on the same households over a long period (e.g. 10-20 years) is required to address this issue, which is beyond the scope of this PhD study.

Table 8.10: Poverty by household types

Household types	Poverty headcount rate (%)			Distribution of the poor (%)		
	1985-86	**2005**	**Change**	**1985-86**	**2005**	**Change**
			Upper poverty line			
Rural household	**65.2**	**44.9**	**-20.3**	**100.0**	**100.0**	**0.0**
Non-farm household	***80.1***	***48.8***	***-31.3***	***36.5***	***32.8***	***-3.7***
Farm household	***58.8***	***43.2***	***-15.7***	***63.5***	***67.2***	***3.7***
Large farmer	0.0	0.0	0.0	0.0	0.0	0.0
Medium farmer	0.0	0.0	0.0	0.0	0.0	0.0
Small farmer	54.5	41.1	-13.4	40.5	26.6	-13.8
Agricultural labourer	100.0	69.2	-30.8	23.0	40.6	17.6
			Lower poverty line			
Rural household	**47.0**	**27.3**	**-19.6**	**100.0**	**100.0**	**0.0**
Non-farm household	***68.5***	***21.4***	***-47.1***	***43.3***	***23.6***	***-19.8***
Farm household	***37.9***	***29.9***	***-8.0***	***56.7***	***76.4***	***19.8***
Large farmer	0.0	0.0	0.0	0.0	0.0	0.0
Medium farmer	0.0	0.0	0.0	0.0	0.0	0.0
Small farmer	25.8	15.8	-10.0	26.6	16.8	-9.8
Agricultural labourer	94.3	62.1	-32.2	30.1	59.7	29.6

Note: Changes shown between years 1985-86 and 2005

Source: Author's calculation using data from BBS HHES 1985-86 and HHIES 2005

8.3.1.5 Poverty by Involvement with the Rice Market

Considering household involvement with rice market, net sellers experienced an increase in poverty but net buyers experienced a decrease in poverty during 1985-86 to

2005 as shown in Table 8.11. A large proportion of net sellers entered into poverty considering both upper and lower poverty lines in 2005 compared to 1985-86. On the other hand, net buyers experienced a large reduction in poverty during 1985-86 to 2005, considering both upper and lower poverty lines. Therefore, during this period net sellers experienced an increase in poor population considering both upper and lower poverty lines by 22.1 and 30.9 percent respectively, whereas net buyers experienced a decrease in poor population by exactly the same proportions. This analysis has reinforced that net sellers did not gain as much as net buyers gained from agricultural trade liberalisation because a large proportion of their population entered into poverty in the post-liberalisation period, whereas net buyers gained more as they experienced a large reduction in poverty during the same period. This result suggests that the reduction of the producer’s price of rice was proportionately larger than the increase in productivity of rice in the post-liberalisation period; therefore, agricultural trade liberalisation adversely affected net sellers and positively affected net buyers.

Considering the upper poverty line, there was a large increase in the proportion of poor net sellers from 27.2 percent in 1985-86 to 49.3 percent in 2005. Similarly, considering the lower poverty line, the poor net seller population increased from 23.1 percent in 1985-86 to 54.0 percent in 2005. Considering both the upper and lower poverty lines, the increase in the poor net seller population was 22.1 and 23.1 percent respectively during 1985-86 to 2005. On the other hand, there was a similar proportion of decrease in the poor net buyer population during the same period considering both upper and lower poverty lines. Thus, a large proportion of poor net buyers became net sellers because of the increase in productivity of rice, thereby raising the poor population of net sellers during this period.

Table 8.11: Poverty by net seller and net buyer household

	Poverty headcount rate (percent)			**Distribution of the poor**		
	1985-86	**2005**	**Change**	**1985-86**	**2005**	**Change**
Household type	**Upper poverty line**					
Net seller	10.2	36.4	26.2	27.2	49.3	22.1
Net buyer	79.5	58.0	-21.5	72.8	50.7	-22.1
Household type	**Lower poverty line**					
Net seller	9.0	24.3	15.3	23.1	54.0	30.9
Net buyer	64.5	32.1	-32.4	76.9	46.0	-30.9

Note: Changes shown between years 1985-86 and 2005

Source: Author’s calculation using data from BBS HHES 1985-86 and HHIES 2005

8.3.1.6 Decomposition of Poverty

8.3.1.6.1 Poverty Decomposition by Farm and Non-farm Household

This section examines the decomposition of poverty to quantify the relative contributions of changes in poverty within sectors and inter-sector population shifts to changes in aggregate poverty. Sectors are defined as farm and non-farm household groups in this decomposition. The change in poverty is decomposed into three effects: intra-sector, inter-sector, and interaction effects. The intra-sector effect represents the change in poverty attributable to changes in poverty rates, holding the population share constant at the initial level (Haughton and Khandker, 2009: 70). In other words, this is the change in poverty that would have occurred if population shares in each group did not change. The inter-sector (population shift) effect represents the changes in poverty attributable to changes in population share in each sector, holding the poverty level within a sector constant (Haughton and Khandker, 2009: 71). The interaction component denotes the changes in poverty attributable to both changes in population shares and poverty levels in sectors. It can be interpreted as a measure of correlation between population shifts and intra-group changes in poverty (Chatti and El Lahga, 2008: 185; Ravallion and Huppi, 1991: 64).

As shown in Table 8.12, the change in poverty is mainly due to an intra-sectoral effect for the cases of both upper and lower poverty lines. The inter-sectoral effect (population shift) on absolute poverty change was positive; therefore, its effect on percentage poverty change was negative for the cases of both upper and lower poverty lines, suggesting that the inter-sectoral effect contributed to an increase in poverty during 1985-86 to 2005. The interaction effect contributed to poverty reduction in this period but only by an insignificant proportion of total reduction.

Considering the upper poverty line, the total amount of reduction in poverty was 20.29 percent in absolute terms. Of this amount the total intra-sectoral effect, inter-sectoral effect (population shift) and interaction effect was –20.32, 0.09 and –0.45 percent respectively. The farm and non-farm sector contributed to total intra-sectoral effect by –9.30 and –11.01 percent respectively in absolute terms and by 54.27 and 45.85 percent respectively in percentage share of poverty reduction. Considering the lower poverty line, the absolute reduction in poverty was –19.63 percent. The intra-sectoral effect, inter-sectoral and interaction effect contributed to this reduction by −19.59, 0.13 and −0.17 percent respectively in absolute terms. The farm and non-farm sector contributed to intra-sectoral effects by −5.59 and −14.00 percent respectively in absolute terms and by 28.45 and 71.34 percent respectively in percentage share.

This analysis suggests that the reduction in poverty in the lower poverty line was mostly attributed to the non-farm sector; therefore, the farm sector's contribution to this reduction was not large. As calculated from data of various household surveys, the farm sector's average share of total rural households was 72 percent and the non-farm sector covered the remaining 28 percent during 1985-86 to 2005. The farm sector captured a noticeably larger share of rural households but contributed to poverty reduction by a lower proportion resulting in a low reduction in poverty during this period.

Table 8.12: Decomposition of poverty by farm and non-farm household: 1985-86 to 2005

	Absolute change	**Percentage change**
Upper Poverty Line		
Change in poverty	-20.29	100.00
Total intra-sectoral effect	-20.32	100.12
Population-shift effect	0.09	-0.45
Interaction effect	-0.07	0.33
Intra-sectoral effects:		
Non-farm household	-9.30	45.85
Farm household	-11.01	54.27
Lower Poverty Line		
Change in poverty	-19.63	100.00
Total intra-sectoral effect	-19.59	99.81
Population-shift effect	0.13	-0.67
Interaction effect	-0.17	0.86
Intra-sectoral effects:		
Non-farm household	-14.00	71.34
Farm household	-5.59	28.48

Note: Changes shown between years 1985-86 and 2005

Source: Author's calculation using data from BBS HHES 1985-86 and HHIES 2005

8.3.1.6.2 Poverty Decomposition by Household Types

Further decomposition of poverty by types of household during 1985-86 to 2005 is shown in Table 8.13. Here types of households are considered as sectors. Amongst the farm households, the contribution of small farmers and agricultural labourers to total poverty reduction through intra-sectoral effect was very similar considering both the upper and lower poverty lines during this period. Considering the upper poverty line, small farmers and agricultural labourers contributed to total intra-sectoral effect by −6.46 and −4.61 percent respectively in absolute terms and by 31.84 and 22.71 percent respectively in percentage share of total reduction in poverty. Similarly, considering, the lower poverty line, small farmers, and agricultural labourers contributed to total intra-sectoral effects by −4.86 and −4.82 percent respectively in absolute change and by 24.74 and 24.57 percent respectively in percentage change of poverty. Noticeably, the inter-sectoral effect (population-shift) had a negative impact on poverty reduction considering both upper and lower poverty lines and this effect was considerably large (−30.32 percent) for the lower poverty line. Therefore, the inter-sectoral effect (change in sectoral share of population arising from population growth and population shift from one sector to another, or from one group to another group of households) negatively affected poverty reduction, thereby contributing to more poverty in rural households during 1985-86 to 2005. Considering the upper poverty line, the population shift effect contributed to an increase in poverty by 1.11 percent in absolute change and by −5.47 percent in percentage change in rural poverty during this period. Similarly, considering the lower poverty line, it contributed to an increase in poverty by 5.95 percent in absolute change and by −30.32 percent in percentage change in rural poverty during this period. This is a clear indication that high population growth in Bangladesh adversely affected poverty reduction through changes in sectoral-share of the population during this period.

Table 8.13: Decomposition of changes in rural poverty by household types: 1985-86 to 2005

	Absolute change	Percentage change
Upper poverty line		
Change in poverty	-20.29	100.00
Total intra-sectoral effect	-20.38	100.40
Population-shift effect	1.11	-5.47
Interaction effect	-1.03	5.07
Intra-sectoral effects:		
Large farmer	0.00	0.00
Medium farmer	0.00	0.00
Small farmer	-6.46	31.84
Agricultural labourer	-4.61	22.71
Non-farm household	-9.30	45.85
Lower poverty line		
Change in poverty (P0)	-19.63	100.00
Total intra-sectoral effect	-23.68	120.65
Population-shift effect	5.95	-30.32
Interaction effect	-1.90	9.67
Intra-sectoral effects:		
Large farmer	0.00	0.00
Medium farmer	0.00	0.00
Small farmer	-4.86	24.74
Agricultural labourer	-4.82	24.57
Non-farm household	-14.00	71.34

Note: Changes shown between years 1985-86 and 2005

Source: Author's calculation using data from BBS HHES 1985-86 and HHIES 2005

8.3.2 Poverty by Household Characteristics

Some important characteristics of rural households associated with agricultural trade liberalisation were examined here to see if they have significant impact on poverty reduction, and to analyse how poverty varies across various characteristics of household heads. These characteristics include employment status, education, gender, and land ownership.

8.3.2.1 Poverty by Employment Status of Household Heads

The employment status of household heads implies their participation in workforce. As revealed in the HHS-2010, employers were the rich households in the rural economy and they were large and medium farmers as well as non-farm business owners. Household heads with self-employed status mainly belong to small farmers. Similarly, household heads with employee status are agricultural labourers and non-farm workers. Household heads with other category of employment status were unemployed and casual workers.

Table 8.14 illustrates the condition of poverty by employment status of household heads. Considering both the upper and lower poverty lines, it is evident that the incidence of poverty for employees is higher than that of either self-employed or other category of employment. Employees are mainly agricultural labourers. On the other hand, employers and self-employees are mainly large and medium farmers.

Table 8.14: Poverty by household head's employment status

	Poverty headcount rate			Distribution of the poor		
	1985-86	2005	Change	1985-86	2005	Change
Upper poverty line						
Employer	0.0	0.0	0.0	0.0	0.0	0.0
Self-employed	56.2	41.2	-15.0	42.6	39.6	-3.0
Employee	77.4	46.3	-31.1	45.7	38.9	-6.8
Other	64.3	51.4	-12.9	11.7	21.5	9.8
Lower poverty line						
Employer	0.0	0.0	0.0	0.0	0.0	0.0
Self-employed	36.9	22.0	-14.9	38.8	34.7	-4.1
Employee	66.1	29.9	-36.2	54.1	41.3	-12.8
Other	27.9	35.0	7.1	7.1	24.0	17.0

Note: Changes shown between years 1985-86 and 2005
Source: Author's calculation using data from BBS HHES 1985-86 and HHIES 2005

8.3.2.2 Poverty by Household Head's Education

The household head's education level is measured by two categories: literate and illiterate. Considering the upper and lower poverty lines, both types of households with literate and illiterate household heads had similar levels of poverty in 1985-86 but households with literate household heads had much lower poverty than households with illiterate household heads in 2005 as shown in Table 8.15.

In 1985-86 households with literate and illiterate household heads experienced poverty by 63.0 and 66.4 percent respectively with the upper poverty line and by 46.8 and 47.1 percent respectively with the lower poverty line. Similarly, households with literate and illiterate household heads experienced poverty by 38.0 and 51.1 percent respectively with the upper poverty line and by 23.6 and 37.07 percent respectively with the lower poverty line in 2005. Therefore, households with literate and illiterate household heads experienced a decrease in poverty by –25.0 and –15.4 percent respectively with the upper poverty line and by –23.2 and –16.3 percent respectively with the lower poverty line during 1985-86 to 2005. This is a clear indication that households with literate household heads had a positive impact on poverty reduction. Interestingly, considering the distribution of the poor, households with literate household heads experienced an increase in poor population by 4.1 percent with the upper poverty line and 3.8 percent with the lower poverty line; therefore, households with illiterate household heads experienced a decrease in poor population by same proportion during that period. This analysis suggests that the proportion of poor households with literate household heads increased during this period. This might be attributed to less employment opportunities for the literate population in the rural economy.

Table 8.15: Poverty by household head's education level

	Poverty headcount rate (percent)			Distribution of the poor		
	1985-86	2005	Change	1985-86	2005	Change
Upper poverty line						
Literate	63.0	38.0	-25.0	36.2	40.3	4.1
Illiterate	66.4	51.1	-15.4	63.8	59.7	-4.1
Lower poverty line						
Literate	46.8	23.6	-23.2	37.3	41.1	3.8
Illiterate	47.1	30.7	-16.3	62.7	58.9	-3.8

Note: Changes shown between years 1985-86 and 2005

Source: Author's calculation using data from BBS HHES 1985-86 and HHIES 2005

8.3.2.3 Poverty by Gender of Household Heads

Households with male household heads were involved in a wider range of economic activities compared to female-headed households who are predominantly involved in agriculture. The majority of rural household heads in Bangladesh were male, because of conventional social order – the male is the head of a household. A female usually becomes the head of a household when her husband dies or if they separate.

As calculated from various household survey data, 92 percent of poor households were male-headed and the remaining 8 percent of households were female-headed in 1985-

86. Similarly, households with male and female household heads were in poverty by 94 and 6 percent respectively in 2005. There is conventional wisdom and belief that the gender of the household head significantly influences household poverty – households headed by females are more likely to be poor than those headed by males (Haughton and Khandker, 2009: 149, 150). This belief is based on the arguments that female heads of rural households have lower levels of literacy, are paid lower wages, and have less access to land or equal employment in developing countries (Chatti and El Lahga, 2008: 185; Haughton and Khandker, 2009: 150; Ravallion and Huppi, 1991: 64). Surprisingly, it was found that poverty rates were not higher amongst female-headed households than male-headed households in Bangladesh during 1985-86 to 2005. Comparing the performance of male and female heads of households in poverty reduction, females performed better than males during 1985-86 to 2005 as shown in Table 8.16. Male and female-headed households experienced a reduction in poverty by −19.9 and −25.2 percent respectively with the upper poverty line and −19.3 and −24.2 percent respectively with the lower poverty line during this period.

Therefore, female-headed households experienced a larger poverty reduction than male-headed households with both upper and lower poverty lines, suggesting that female-headed households managed and used resources for poverty reduction better than male-headed households during this period. The study further explored some basic socio-economic factors that might have contributed to this better performance of female-headed households, and the result is presented in Table 8.17.

Table 8.16: Poverty by household head's gender

	Poverty headcount rate (percent)		
	1985-86	**2005**	**Change**
Upper poverty line			
Male	64.9	45.0	-19.9
Female	68.3	43.1	-25.2
Lower poverty line			
Male	46.8	27.5	-19.3
Female	48.6	24.4	-24.2

Note: Changes shown between years 1985-86 and 2005

Source: Author's calculation using data from BBS HHES 1985-86 and HHIES 2005

This study found that household mean income, consumption, size, and the household head's age contributed to better performance of female-headed households in poverty reduction than male-headed households. The distribution of income and consumption amongst female-headed households was relatively even compared to male-headed households. The standard deviations of income and consumption for male-headed households were larger than for those of female-headed households, indicating larger inequality in income distribution for male-headed households. Conversely, female-headed households experienced smaller standard deviations in distribution of income and consumption, suggesting less inequality in income distribution that might have contributed to greater reduction in poverty. Similarly, female-headed households had a smaller average household size (4.67) than the size (5.19) of male-headed households in 2005. In addition, the mean age of female household heads was higher than that of male-headed households in both 1985-86 and 2005. This is an indication that female-headed households had better supportive networks such as more income earners (grown children) than male-headed households.

Table 8.17: Comparison of means by household head's gender

Factors		1985-86		2005	
	Statistics	Male	Female	Male	Female
Household income	**Mean**	2185.47	1974.75	6182.52	3900.67
	Std. deviation	1398.68	822.99	7299.39	2785.61
Household consumption expenditure	**Mean**	2093.3	1878.88	5633.38	3726.00
	Std. deviation	1545.97	764.41	5014.29	2160.20
Household size	**Mean**	5.67	5.63	5.19	4.67
	Std. deviation	1.42	1.19	1.29	1.03
Household head's age	**Mean**	39.49	46.50	39.77	45.67
	Std. deviation	9.46	7.27	7.91	5.20

Source: Author's calculation using data from BBS HHES 1985-86 and HHIES 2005

8.3.2.4 Poverty by Land Ownership

Land is considered one of the most important resources for rural households because it is related directly and indirectly to their income, consumption, and employment. Therefore, land ownership is an important determinant of poverty in rural Bangladesh. Table 8.18 illustrates the state of poverty by land ownership. The incidence of poverty for landless was higher than that of landowners considering both upper and lower poverty lines and in both 1985-86 and 2005. This is a clear indication that landless were more vulnerable to poverty than landowner households. However, landless households experienced a larger reduction in poverty than those of landowners considering both the upper and lower poverty lines during 1985-86 to 2005. They experienced a larger reduction in poverty with the lower poverty line by –52.7 percent compared to a reduction in poverty with the upper poverty line by –28.4 percent during that period. This implies that landless households are net buyers of rice and they benefited from the lower consumer price of rice in the post-liberalisation period; therefore, they experienced a larger reduction in poverty than that of landowner households.

On the other hand, considering the distribution of the poor, landowners experienced a decrease in the proportion of poor population by –5.4 percent with the upper poverty line and –1.4 percent with the lower poverty line, whereas landless households experienced an increase in the proportion of poor population during that period. This finding suggests that there is a proportional increase in landless poor than landowner poor households and that increase might have happened from growth in both poor population and landless households – those landowner poor households who became landless in the post-liberalisation period.

Table 8.18: Poverty by landless and landowner households: 1985-86 to 2005

	Poverty headcount rate			Distribution of the poor		
	1985-86	**2005**	**Change**	**1985-86**	**2005**	**Change**
Upper poverty line						
Landless	100.0	71.6	-28.4	14.8	20.3	5.4
Land owner	61.4	41.0	-20.5	85.2	79.7	-5.4
Lower poverty line						
Landless	100.0	47.3	-52.7	20.6	22.0	1.4
Land owner	41.3	24.4	-16.9	79.4	78.0	-1.4

Note: Changes shown between years 1985-86 and 2005

Source: Author’s calculation using data from BBS HHES 1985-86 and HHIES 2005

8.3.3 Decomposition of Poverty Change

The level of poverty may change due to changes in mean income or consumption relative to the poverty line, or due to changes in relative inequality (Datt and Ravallion, 1992: 277). The growth-inequality decomposition, as introduced by Datt and Ravallion (1992), quantifies the relative contribution of growth and redistribution (changes in inequality) to changes in poverty. The decomposition results denote whether changes in welfare (income) distribution have offset gains from economic growth in reducing poverty (Datt and Ravallion, 1992: 278; Ravallion and Huppi, 1991: 64). The change in poverty is decomposed into three components: growth, redistribution and residual or interaction. The growth component represents the change in poverty attributable to changes in mean welfare (economic growth) when holding the relative distribution of the reference year constant. The redistribution component represents the change in poverty attributable to changes in the distribution curve (percentile mean incomes or Lorenz curve) holding mean welfare constant. The residual or interaction component represents the effect of simultaneous changes in mean income and redistribution on poverty that is not accounted for by either of the other two components – that cannot be exclusively attributed to growth or redistribution (World Bank, 2010: 1). The residual will only become zero if the distributional-neutral-growth effect on poverty is independent of the Lorenz curve (Ravallion and Huppi, 1991: 64).

The decomposition of poverty-change into three components is presented in Table 8.19. The results suggest that if redistribution were held constant at the initial level of 1985-86, the economic growth that took place during 1985-86 to 2005 was sufficient for reducing poverty to zero level in 2005, as revealed by the growth component in the table – the growth effect on poverty reduction was the same as the initial level of poverty for all groups of rural households considering both upper and lower poverty lines. The redistribution component of the table had large and positive values for all groups with both upper and lower poverty lines, suggesting that economic growth was not distributed equally; rather there was a huge inequality in income distribution which significantly offset the growth effect on poverty reduction. In fact, farm households experienced the worst redistribution effect amongst rural households with the largest redistribution values (highest inequality) considering both upper and lower poverty lines. Considering the upper poverty line, the interaction component had positive values for all groups of rural households, suggesting that it offset the growth effect on poverty reduction and helped to sustain the initial level of poverty. However, considering the lower poverty line, the interaction component had negative values for all groups of rural households, implying that it influenced poverty reduction along with the growth effect at the lower poverty line.

Table 8.19: Growth and redistribution decomposition of poverty changes

	Headcount rate		Decomposition of change in poverty			
	1985-86	2005	Actual change	Growth	Redistribution	Interaction
Upper poverty line						
Rural household	65.16	44.87	-20.29	-65.16	31.27	13.59
Non-farm household	80.10	48.80	-31.30	-80.10	16.63	32.17
Farm household	58.84	43.17	-15.67	-58.84	36.58	6.59
Lower poverty line						
Rural household	46.97	27.34	-19.63	-46.97	48.85	-21.50
Non-farm household	68.47	21.37	-47.10	-68.47	28.26	-6.89
Farm household	37.87	29.92	-7.95	-37.87	57.55	-27.63

Source: Author's calculation using data from BBS HHES 1985-86 and HHIES 2005

8.3.4 Growth Elasticity of Poverty

The growth elasticity of poverty indicates how effectively economic growth has translated into poverty reduction. It is the percentage change in poverty with respect to one percent change in per capita welfare or growth (mean income or consumption per capita). It is used for capturing a variation in the sensitivity of poverty reduction to growth. It is a partial measure to estimate the change in headcount poverty with one percent change in growth holding inequality constant (Ravallion and Huppi, 1991: 64). The growth elasticity of poverty is presented in Table 8.20. As expected, the signs of all elasticity coefficients are negative. The negative signs of elasticity coefficients indicate an inverse relationship between consumption and poverty – an increase in consumption will reduce poverty. The larger the value of the coefficient in absolute terms, the greater is the impact of consumption on poverty reduction. The change components measure the magnitude of changes in elasticity coefficients. Considering the upper poverty line, non-farm households had the largest elasticity coefficient amongst rural households. On the other hand, farm households had the lowest elasticity coefficient for both 1985-86 and 2005. Similarly, non-farm households had the largest elasticity coefficient in 2005 and marginally the smallest elasticity coefficient in 1985-86. This analysis suggests that an increase in consumption by 1 percent would contribute to the largest reduction in poverty for the non-farm household. Indeed, non-farm households experienced the largest reduction in poverty during 1985-86 to 2005.

Table 8.20: Growth elasticity of poverty with respect to consumption

	Elasticity of poverty coefficient		
	1985-86	**2005**	**Change**
Upper poverty line			
Rural household	-2.84	-4.80	-1.96
Non-farm household	-4.81	-8.71	-3.90
Farm household	-1.88	-2.82	-0.94
Lower poverty line			
Rural household	-5.59	-8.09	-2.50
Non-farm household	-5.40	-8.65	-3.26
Farm household	-5.73	-7.91	-2.18

Note: Changes shown between years 1985-86 and 2005

Source: Author's calculation using data from BBS HHES 1985-86 and HHIES 2005

Elasticity coefficients of poverty with respect to inequality are presented in Table 8.21. In this case, elasticity is measured considering inequality only and growth is held constant. As expected, the signs of all elasticity coefficients are positive, implying that the relationship between poverty and inequality is positive or direct – an increase in inequality will result in an increase in poverty. The elasticity of poverty coefficients for non-farm households were the lowest whereas these coefficients for the farm households were the largest considering both upper and lower poverty lines in both 1985-86 and 2005. This analysis also suggests that non-farm households are likely to experience the lowest level of increase in poverty and farm households are likely to experience the largest increase in poverty as a result of a 1 percent increase in inequality. Conversely, from a decrease in inequality by 1 percent, farm households will experience a larger reduction in poverty than that of non-farm households.

Table 8.21: Elasticity of poverty with respect to inequality

	Elasticity of poverty coefficient		
	1985-86	**2005**	**Change**
Upper poverty line			
Rural household	2.14	4.72	2.58
Non-farm household	1.95	3.07	2.12
Farm household	2.91	5.79	2.88
Lower poverty line			
Rural household	3.87	8.09	4.22
Non-farm household	1.21	4.73	3.52
Farm household	4.12	8.39	4.27

Note: Changes shown between years 1985-86 and 2005

Source: Author's calculation using data from BBS HHES 1985-86 and HHIES 2005

8.4 Conclusion

The income distribution across rural households was uneven in the post-liberalisation period. Although agricultural trade liberalisation generated significant growth, inequality also increased and the rich gained more from this growth than the poor. Therefore, poverty reduction in the post-liberalisation period was not as significant as the growth in the economy. Amongst rural households, non-farm households gained more than farm households from post-liberalisation growth because of a relatively large reduction in consumer price compared to increases in productivity of rice. The above findings suggest that, holding inequality constant at the 1985-86 level, rural poverty in Bangladesh could be reduced to zero with the growth experienced during 1985-86 to 2005. However, the total reduction in poverty was insignificant during this period because of a gradually higher increase in inequality and the effects of high economic growth resulting from agricultural trade liberalisation were not fully converted to reduction in poverty. This analysis suggests that a reduction in poverty at a substantial level is a big challenge for policy makers if inequality is not reduced or maintained constant.

Although this chapter analysed the impact of agricultural trade liberalisation on poverty, inequality and income distribution, it did not analyse how it affected the environment and other socio-economic conditions such as development of the non-farm sector. The following chapter, Chapter 9, analyses the impact of agricultural trade liberalisation on the environment and other socio-economic activities.

CHAPTER NINE

Agricultural Trade Liberalisation: Environmental and Socio-economic Impact and Household Welfare

9.1 Introduction

Chapter Six analysed how agricultural trade liberalisation impacted on productivity of rice as a result of technological transformation. Bangladesh experienced significant growth in total factor productivity of rice in the post-liberalisation period. The increase in productivity and total rice production was mainly due to cropping shift from local varieties to HYV rice and reallocation of resources in favour of HYV dominated Boro rice in the post-liberalisation era. Chapter Seven focused on how increased productivity influenced the welfare of rural households through changes in producer and consumer prices of rice. Increased productivity induced reduction in both producer and consumer prices of rice. However, reduction in producer price was greater than in consumer price, suggesting that net buyers benefited more than net sellers. Although all rural households experienced growth in both income and consumption in the post-liberalisation period, rich households gained more than poor households suggesting that the growth was not pro-poor. Chapter Eight analysed that, along with economic growth, inequality also increased. Therefore, poverty reduction was not significant in the post-liberalisation period. Non-farm households experienced a greater poverty reduction than farm households, suggesting that non-farm household (net buyers) gained more from the growth than farm households.

While the focus of these findings have been on the economic aspects, the welfare of rural communities is far more than just income, consumption and their distributional characteristics. Changes in technology, growth in production and overall economic growth stimulus from agricultural trade liberalisation have environmental, social and other effects that also impact on the welfare of rural households.

This chapter examines the environmental and other socio-economic impacts of agricultural trade liberalisation that have not been analysed in previous chapters.

Agriculture and environment are closely related because of agriculture's critical link with two main natural resources – land and water. Similarly, other agricultural inputs such as chemical fertilisers and pesticides have direct consequences for the environment. Inappropriate use of natural resources and improper application of agricultural inputs to rice cultivation adversely affect the environment with serious implications such as imbalance of soil nutrients, loss of bio-diversity, destruction of insects and other fauna, and creation of hazards to human health. Agricultural trade liberalisation also has other socio-economic impacts such as changes in working relationships amongst the rural households, changes in infrastructure, development of the non-farm sector etc, which were not analysed in previous chapters.

The focus of this chapter is to critically examine the environmental and socio-economic impacts arising from the intensive use of land and water; extensive application of chemical fertilisers and pesticides; changes in social relationships in rural communities; and the development of infrastructure and rural non-farm sector due to agricultural trade liberalisation.

9.2 Environmental Impacts

9.2.1 Use of Natural Resources

Land and water are the two main natural resources linked directly with rice production in Bangladesh. Their intensive use to increase rice production has direct implications on the welfare of rural households.

9.2.1.1 Impact on Land Use

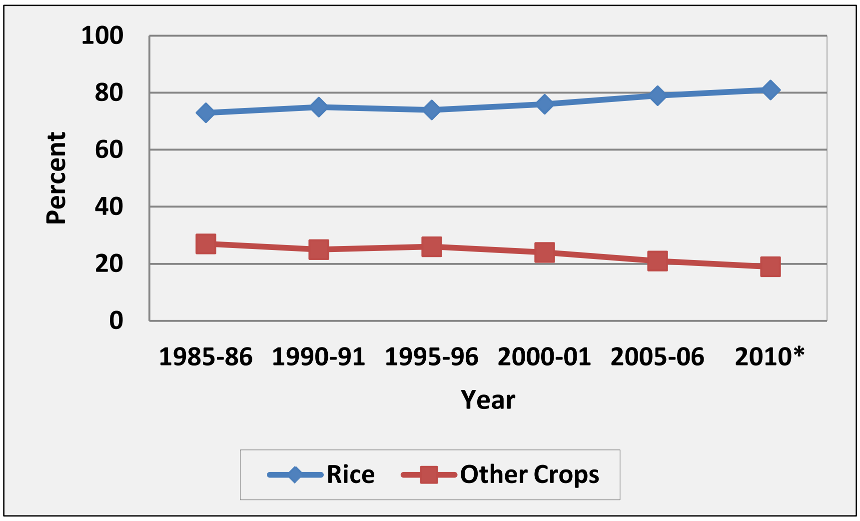
Land is a scarce resource in Bangladesh because the size of land is very small compared to the very large size of population. The HHS-2010 revealed that the ratio of land per person was 0.28 acre. The average farm size is very small, 1.80 acre, thereby making agriculture mainly subsistent. Thus, most farmers are involved in intensive farming of rice – the staple food. In 2010, the share of land between rice crops, other crops, and other agricultural activities was 72, 19, and 9 percent of total cultivated land respectively. Other crop categories include cereals (other than rice), cash crops, pulses, oilseeds, vegetables, and fruits. Other agricultural activities include dairy, poultry, and fisheries. In the HHS-2010, all respondents opined that farmers engaged too much land in rice cultivation. The main reason is that the majority of farm households were small farmers, who were basically poor and were much more concerned with producing rice for subsistence than as a source of income. The respondents suggested that technological transformation in agriculture resulting from trade reforms made rice production more competitive than other crops. These socio-economic conditions compelled farmers to engage the largest share of land in rice production. This finding suggests that small rice farmers are realistic in their production decisions and rational in terms of reallocation of resources in favour of more competitive economic activity – rice production.

The HHS-2010 revealed that the dominant position of agriculture in rural economic activities necessarily put enormous pressure on land and other natural resources. The intensive use of land in rice production leads to over-exploitation of natural resources that damages the environment, thus raising serious doubts about environmental sustainability of rice production.

9.2.1.2 Impact on Cropping Diversity

Rice cultivation dominates the farming system, thereby adversely affecting the cropping diversity. Rice cultivation gradually captured a larger share of land allocated for crop production, growing from 73 percent in 1985-86 to 81 percent in 2010.

Figure 9.1: Share of land for rice and other crops in selected years: a comparison



Source: Author's calculation from various tables (Ministry of Agriculture, 2007); and *HHS-2010 conducted by the author

There are positive impacts of cropping diversity on soil fertility and risks of crop failure. For example, cropping diversity increases the fertility of soils and maintains the natural balance of soil nutrition content as different crops need different combination of soil nutrition and different crops add different combinations of nutrition to soil through residues on/in the ground such as roots, stubble, straw and leaves. Similarly, cropping diversity minimises the risk of crop failure caused by natural calamities such as floods, droughts and pests as often occurred in Bangladesh.

The decline in cropping diversity in Bangladesh's agriculture portends adverse impacts on soil fertility and balance of soil nutrients. One of the consequences is the growing dependence on urea fertiliser because intensive rice cultivation requires a large proportion of urea in soil. Maintaining a balance between rice cultivation and other crops increases cropping diversity, with greater potential to maintain soil fertility in terms of more balance of soil nutrients (Iqbal, 2008: 2661; Pagiola, 1995: 5; Rahman, 2010: 254; World Bank, 2006: 61).

9.2.1.3 Impact on Domestic Cattle Farming

The HHS-2010 revealed that domestic cattle husbandry, which was traditionally an important sector in the rural economy of Bangladesh, has declined drastically. This sector developed in rural areas because a large proportion of the rural population was either unemployed or seasonally unemployed, and because of the availability of free grazing fields for domestic cattle farming. It was an important source of income, employment and nutrition for the rural communities – income from sales of domestic cattle and nutrition from milk and meat. Waste from cattle dung also provided farmers with organic manure and fuel. In addition, land preparation for rice cultivation used cattle ploughs in the pre-liberalisation period. This traditional sector has almost disappeared from the rural economy due to technological innovation in the rice production resulting from agricultural trade liberalisation.

The HHS 2010 revealed that in 1990, 56 percent of rural households had traditional domestic cattle such as cows, buffalos and goats; but only 7 percent of them had domestic cattle in 2010. The steady decline in the number and size of grazing fields, resulting from increased cropping intensity and expansion of rice fields in the post-liberalisation period was a major factor in this decline. Almost 96 percent of the respondents in the survey suggested that the traditional grazing fields were converted to rice fields because of the adoption of improved rice production technology – a combination of irrigation, fertilisers, and HYV seeds. Availability of cheap irrigation equipment facilitated the expansion of rice cultivation in the dry season (Boro crop) on dry land, which was usually left fallow and used as grazing fields. The HYV rice gradually captured the land from local varieties. The duration of the HYV cultivation cycle (from planting to harvesting) is much shorter than that of local varieties of rice, thereby increasing the cropping intensity but reducing the area and fallow period of grazing fields for domestic cattle.

9.2.1.4 Impact on Mechanised Cultivation

Traditionally, rice cultivation in Bangladesh was based on manual operations from land preparation to harvesting. This tradition continued, except in the case of land preparation. Rice farmers shifted land preparation processes from the traditional ploughing system with bullocks to the modern cultivation method with powered tillers – a process of mechanised cultivation. The HHS 2010 revealed that almost all farmers were partially or fully dependent on traditional ploughing with bullocks (cows and buffalos) even in the early 1990s. This was almost completely reversed in 2010, when 92.1 percent of survey respondents stated that they ploughed their land with powered tillers. Only 5.3 percent of the farmers used bullocks and 2.6 percent used spades for land preparation. Technological transformation from traditional to modern cultivation system resulted from the complex mix of factors including the decline in availability of bullocks, availability of cheap and more efficient powered tillers.

9.3 Water Resource and Irrigation

Water is critical to the life of the rural households for drinking, other household purposes, and irrigation. The use of water for irrigation affects other water usages of rural household in a variety of ways including the availability and quality of drinking water, impact on water bodies themselves and aquatic life, and the use of water transports.

The HHS-2010 revealed that 85 percent of rural households used shallow tube-wells and ring-wells and 15 percent used other sources (rivers, ponds, and dug-wells) as sources of drinking water. Shallow tube-wells extract groundwater ranging from 10 to 50 metre depth and ring-wells extract water from underground storage ranging from 6 to 15 metre depth.

In the HHS 2010, 55 percent of respondents indicated that irrigation did not affect the availability and quality of drinking water. They suggested that the supply of drinking water mostly came from underground sources whereas irrigation in the rice fields was mostly extracted from surface water such as rivers, canals, lakes and ponds through low-lift pumps. On the other hand, 41.7 percent of the respondents opined that irrigation in the rice fields had a significant impact on the availability and quality of drinking water. They suggested that deep tube-wells and shallow tube-wells extracted large amounts of groundwater for irrigation lowering groundwater levels for drinking water (7-50 metres) during the dry season, which resulted in a shortage of drinking water in rural areas. This situation became further complicated because evaporation-transpiration was highest during the dry season, the time of the highest extraction of groundwater for irrigation in the Boro rice fields with deep tube-wells and shallow tube-wells. Therefore, extraction of a large amount of groundwater for irrigation affects the availability of drinking water for many rural households. Similarly, irrigation with deep tube-wells and shallow tube-wells brings up hazardous underground-minerals such as arsenic and iron, thereby polluting surface drinking water. Respondents in the HHS 2010 expressed concerns regarding excessive levels of arsenic and iron in surface water caused mainly by irrigation. The impact of irrigation on the environment is summarised in Table 9.1.

Table 9.1: Impact of irrigation on water resources

Impacts of irrigation	(in percent)			Examples of specific form of impacts
	Yes	No	Not sure	
Impact on land	76.7	13.3	10.0	**Soil quality:** Increase in iron and salinity on soil; arsenic contamination **[46]**
Impact on water bodies	76.7	13.3	10.0	**Water life:** Low-lift pumps dry up river, lakes and ponds. Irrigation destroys fish and other water creatures and their habitats. Destruction of water vegetation and bio-diversity **[46]**
Impact on availability of drinking water	41.7	55.0	3.3	Lowering groundwater levels, drying surface water **[25]**
Impact on quality of drinking water	41.7	55.0	3.3	Contamination with arsenic and iron **[25]**
Impact on water transportation	63.0	21.2	15.8	Less navigable **[38]**

Note: Figures in parentheses represent actual number of respondents opined the respective view out of the total 60 respondents in the survey
Source: Author's calculation from HHS 2010, conducted by the author

In the HHS-2010, 76.7 percent of participants indicated that irrigation had negative impact on the environment. The impact included arsenic contamination from groundwater, an increase in the level of iron (from underground) on soil and surface water, loss of water life such as fish and insects during the dry season.

Bangladesh is a land of rivers with inland water transportation being an important mode of communication in rural areas. These rivers carry the highest level of water during the rainy season (July-August) but have less flow during other seasons. With the large increase in irrigation, many rivers become less suitable for water transportation during the dry seasons (December-March) because of the large amount of water extracted for irrigation in the Boro rice fields. In the HHS 2010, 63 percent of respondents identified that the rivers were less navigable during the dry season.

9.4 Use of Fertiliser and Pesticide

Agricultural trade liberalisation made chemical fertilisers and pesticides cheaper, thereby encouraging both their intensive and extensive use. Widespread use of chemical pesticide posed serious health risk, as well as ecological damage in the form of environmental degradation and loss of bio-diversity.

The study explored the impact of chemical fertilisers and pesticides on the environment and human health. In the HHS-2010, 71.7 percent respondents opined that chemical fertilisers caused damage to the environment, but there was unanimous agreement by all survey participants that pesticides caused damage to the environment.

Table 9.2: Chemical fertilisers and pesticides causing damage to environment

Response (N = 60)	Fertilisers (percent)	Pesticides (percent)
Yes	71.7	100
No	16.7	0
Not sure	11.6	0

Source: Author's calculation from the HHS-2010 conducted by the author

The environmental impacts of chemical fertilisers and pesticides that survey participants mentioned included degradation of soil fertility, destruction of aquatic life, soil and water pollution, and increase in human-health hazards.

This study also explored the knowledge-basis and manner of application of chemical fertilisers and pesticides by farmers to rice fields. Respondents were asked what informed their knowledge base on how to apply chemical fertilisers and pesticides to rice fields. The key areas that were identified were: knowledge acquired through formal training, and learning from other farmers (Table 9.3). The results were very similar for chemical fertilisers and pesticides. The majority of the farmers used a combination of "knowledge acquired through experience and learnt from other fellow farmers" (66 percent for fertilisers and 68 percent for pesticides). Only 13 percent of farmers acquired their knowledge through a combination of 'training and experience'. Surprisingly, none of the farmers acquired their knowledge through formal training only.

These findings suggest that rice farmers in rural Bangladesh did not acquire formal scientific knowledge base in the form of formal training and education to use chemical fertilisers and pesticides. This implies that there may be inappropriate application of chemical fertilisers and pesticides, and where this is widespread, may have adverse implications for soil fertility, bio-diversity, and human health. These issues are analysed separately in the following sub-sections.

Table 9.3: Basis of the use of fertilisers and pesticides

Basis of use	Fertilisers (%)	Pesticides (%)
Experience	5	8
Learnt from other farmers	3	0
Guess	0	3
Training and experience	13	15
Training and learnt from other farmers	3	0
Experience and learnt from other farmers	66	68
Experience and guess	5	3
Experience, other farmers and guess	5	3

Source: Author's calculation from HHS-2010 conducted by the author

9.4.1 Impact on Soil Fertility

The chemical fertilisers and pesticides have adverse effects on soil fertility. Inappropriate application of fertilisers to the rice fields could adversely affect soil quality and fertility in the form of imbalance in soil's nutritional components resulting in lower average yields of rice per acre. Survey respondents reported that in some cases they experienced a high growth in rice plants but achieved less than average yields per acre, which might be because of inappropriate application in fertilisers terms of quantity and their type of fertilisers. For example, the majority of farmers used urea because they believed that urea was superior to other fertilisers. However, they could not explain the scientific basis of this belief. Inappropriate application of chemical fertilisers and pesticides may also increase chemical contaminants in soil and water as illustrated in section 9.3 of this chapter (see Table 9.1).

9.4.2 Impact on Bio-diversity

The HHS-2010 revealed that rice farmers of Bangladesh used the following chemical fertilisers: urea, triple supper phosphate (TSP), muriate of potash (MOP) and gypsum. Organic fertilisers constituted only a very small proportion of all fertiliser use. The major pesticides used by rice farmer were endrin, DDT (Dichlorodiphenyltrichloroethane), aldrin and chlorane. The HHS-2010 revealed that

DDT is a cheap pesticide and rice farmers used it as both a fertiliser and a pesticide because of their beliefs that DDT not only kills pests but also increases fertility of soil. According to the *Stockholm Convention on Persistent Organic Pollutants (POPs),* all these pesticides are considered highly dangerous pollutants and they pose serious health hazards beyond the national boundaries; because these pesticides possess toxic properties and persist in the environment for a long period (UNEP, 2001: 1, 21, 24). They are transported through air, water and migratory species across international boundaries and deposited far from their place of release, where they accumulate in terrestrial and aquatic ecosystems . The Stockholm Convention on POPs put strict restrictions on production and use of DDT because it causes environmental pollution and soil contamination.

All respondents opined that the abundance of fish, frogs, insects, birds, water snails and other aquatic life in rivers, lakes, ponds and rice fields even available as late as in the 1990s have been considerably diminished. They attributed this to the large-scale use of chemical pesticides as they became cheaper in the post-liberalisation period.

The HHS-2010 further revealed that both adults and children were engaged in the application of chemical fertilisers and pesticides in rice fields. Without appropriate training and knowledge of consequences of inappropriate application, farmers, farm labourers, and even rural residents were at risk of exposure to chemical pesticides particularly when they used them without appropriate instruments. Most farmers applied pesticides to rice fields from buckets, and sprayed manually using hand-held sprayers made of bamboos. They were unaware that inappropriate use of chemical pesticides has adverse impacts on human health. However, the identification and measurement of these impacts was beyond the scope of this study.

9.5 Changes in Social Relationships

9.5.1 Cooperative-based Ownership and Social Relationship

In the pre-liberalisation period, only a limited number of deep tube-wells (DTW) were available for irrigation in the rice fields. They were owned and operated by the government agencies. Agricultural trade liberalisation facilitated farmers to own and operate DTWs in the post-liberalisation period. DTWs are the most expensive and the largest irrigation equipment for rice farming in Bangladesh. As revealed in the HHS-

2010, one DTW usually irrigates around 40-50 hectares of land. As small, medium and even most large farmers operated holdings for less than 40.50 hectares, groups of adjacent farmers came together to pool resources to purchase and operate a DTW jointly. Thus, the growth of irrigation systems with DTWs generated new social relationships amongst the rural farm households as they formed cooperative societies to facilitate the administering and maintenance of DTWs. Members of these cooperative societies were from the same village and/or from different villages. Their activities were not limited to irrigation only but extended to other social relationships, bringing rural households from different villages together. They established social clubs that brought them together for gossip, social interaction and other recreational activities such as reading newspapers, playing cards and carrom boards etc. There were tea-stalls, shops, and evening local markets for vegetables, fish and other local produce. These clubs, local tea stalls, and evening markets became meeting places for various groups of rural people from nearby villages. These findings suggest that technological transformation from agricultural trade liberalisation, as in the case of irrigation system, intensified social ties amongst rural households both within and across different villages. This had the potential to increase social interactions and create networks across rural communities for building social capital.

9.6 Changes in Infrastructure

Rural infrastructure is related directly to the welfare of rural communities. This study explored the impact of agricultural trade liberalisation on the development of rural infrastructure with a view to analysing the changes in welfare of rural households. It analysed the development of rural roads, establishment of new markets, development of storage facilities and transportation facilities in response to growth in production and distribution of rice.

9.6.1 Development of Roads and Transportation Facilities

Transportation and infrastructure are critical for movements of goods in the rural areas of Bangladesh. The HHS-2010 revealed that the principal modes of transportation were walking, bicycles, rickshaws, auto-rickshaws, bus, boats, and trawlers (engine boats, known locally as trawlers). In addition, trucks and human carriage were used to transport goods. All survey respondents identified that they usually used more than one mode of transportation for both personal transport as well as moving goods to the markets. Similarly, all survey respondents opined that the quality and the number of rural roads and modes of rural transport increased in the post-liberalisation era. Obviously, this expansion was to cope with increasing demand from expansion of the rural economy. The development in rural transport infrastructure included the construction of new roads, up-gradation of existing road network and the expansion of modes of transport such as the availability of public transport, particularly buses.

Table 9.4: Change in roads and transportations in rural areas over last five years

	Yes (percent)	No (percent)
New roads developed	100	0
Existing roads improved	100	0
Different modes of transport increased	100	0
Public transport increased	100	0

Source: HHS-2010 conducted by the author

The availability of wider range of transport modes as well as better roads made access to markets easier. More efficient transport system also provided more choice of markets for buyers and sellers.

9.6.2 Establishment of New Rural Markets

The growth of rural markets is related to the size of population, the numbers of buyers and sellers, availability of commodities, household income, and rural transportation facilities. Agricultural trade liberalisation enabled rural communities to experience a large volume of production of rice and other agricultural commodities. The HHS-2010 revealed that the number of rural markets significantly increased. The operation-frequency of some of these markets varied, ranging from 7 days to daily markets a week. Some village markets, popularly known as *haat*, were run at particular times of the day either in the morning or in the evening. The growth and expansion of local village markets had the impact of reducing transportation costs and time saving for farmers and local traders going to distant town markets. No doubt, cost savings from transport had positive impact on household income of rural buyers and sellers.

9.6.3 Storage Facilities

Another important rural infrastructure for farmers is the availability of storage facilities to support increased production of rice. A key constraint for farmers in rural Bangladesh is the lack of public or private storage facilities for agricultural commodities in rural communities. Survey respondents reported that there were two main forms of storage facilities, namely local storage depots and central storage depots in town areas. Family home storage was usually small and limited, supplemented by local storage depots and central storage depots are mainly for storage of rice procured by the government but not for private users. Respondents also reported that the lack of adequate storage compelled small farmers to sell perishable agricultural commodities at lower prices during the harvest season as family residences were not appropriate for storage of rice because of moisture and pests such as rats and insects that damage the rice. Rice farmers experienced sustained loss from improper storage of rice in their houses which impacted on their incomes and food security. Although storage facilities had been developed in rural areas in the post-trade liberalisation period, the small number and the cost of private storage facilities limited their availability and use by small farmers. There was, therefore, a need to build storage facilities in rural areas to support small farmer households.

9.6.4 Rural Electrification

One of the key positive outcomes of agricultural transformation in rural Bangladesh was the establishment of rural electrification programmes. Both the government-owned Power Development Board (PDB) and the privately owned and operated Rural Electrification Board (REB) supplied electricity to ensure constant supply of power for irrigation pumps. The REB was established specifically to supply electricity for DTWs in the rural areas, and played an important role in electrifying villages with the highest priority given to irrigation (DTWs). Thus, while rural and urban households usually experience load shading of electricity round the year, priority was given to irrigation equipment (DTWs) to ensure uninterrupted supply of electricity from the REB.

9.7 Development of Non-farm Sector

One of the major impacts of agricultural trade liberalisation is the growth of the rural non-farm sector through backward and forward linkages with input and output markets. Some of these linkages include the establishment and development of local dealerships for agricultural inputs such as fertilisers, pesticides, and HYV seeds; repairing workshops for irrigation equipment; and the establishment of rice mills in the rural communities.

9.7.1 Private Dealership of Fertilisers, Pesticides and Seeds

Along with agricultural trade liberalisation, the government privatised the distribution and sales of agricultural inputs. This opened up opportunities for private dealerships for farm inputs such as fertilisers, pesticides, and HYV seeds. All survey respondents identified that they bought fertilisers and pesticides from local private dealers. Similarly, 92.7 percent of survey respondents reported that they bought rice seeds from dealers, and only 7.3 percent used their own seeds.

9.7.2 Repair and Maintenance Workshops

Prior to liberalisation, most farmers sourced the repair and maintenance of irrigation equipment from workshops located in the urban areas. Large-scale investment in mechanisation, particularly in irrigation equipment, tractors and other agricultural equipment in the post-liberalisation period created a strong market for equipment repair and maintenance workshops in rural communities. The growth of repair workshops was therefore one of the major growth areas of the rural non-farm sector.

9.7.3 Multi-dimensional Use of LLPs

Amongst all irrigation equipment, low-lift pumps (LLPs) were the most popular and widely used. The use of LLPs was not limited to rice fields, but spread across other areas such as paddy husking and transportation contributing to the introduction of new husking machines and transport in the rural economy. They were used as irrigation equipment during the dry season for rice cultivation and converted to husking machines, engines for small trucks, lorries (known locally as mini-truck for carrying goods), trawlers (local engine boats) and electricity generators. LLPs have revolutionised the rural economy because of their multiple usages. The survey revealed that 95 percent of the respondents used *dhengi* (a wooden instrument operated manually) for husking paddy in the early 1990s. This was reversed, and in 2010, 97 percent of rural households used modern husking machines (converted from LLPs) replacing *dhengi* in the post-liberalisation period. LLPs were also used as engines for small trucks, lorries and trawlers to transport rice, bricks and other goods, and for boat engines for water/river transport both for ferrying passengers and goods movement. Therefore, LLPs played an important role in the development of the rural non-farm sector in the post-liberalisation period.

9.7.4 Establishment of Large-scale Rice Mills

Rural electrification and an increase in the volume of rice production facilitated the establishment of large-scale rice mills in rural areas, mainly by rice traders for making rice from paddy. Rice mills generated large number of employment opportunities related to drying paddy in the sun, packaging rice, operating mills, and transporting rice from the rural areas to urban markets.

9.7.5 Employment and Wages

The growth of the non-farm sector created extensive opportunities for employment and income in the rural economy in many ways as illustrated in the preceding sections. These influenced income-generating opportunities both on- and off-farm. Increased demand for labour in the non-farm sector led to an increase in nominal wages for non-farm workers, who experienced an increase in real wages derived from a lower consumer price of rice. Rural non-farm households, therefore, benefited in three ways: a greater opportunity for employment and income; higher nominal wages derived from a higher demand for labour in the non-farm sector, and higher real wages resulting from a lower consumer price of rice in the post-liberalisation era.

9.8 Conclusion

The findings presented in this chapter suggest that agricultural trade liberalisation influenced the environment and socio-economic conditions of rural households in both positive and negative ways. On the negative side, where rice farmers engaged too much of their cultivable land for rice production, agricultural trade liberalisation resulted in a decrease in cropping diversity, thereby adversely affecting soil fertility. Irrigation caused a shortage of drinking water, destroyed habitats of aquatic life through drying up rivers, lakes and ponds during the dry season. Where rice farmers used fertilisers and pesticides without proper training and scientific knowledge this damaged the environment by creating an imbalance in soil nutrients, destruction of aquatic life, creating environmental pollution, and posed serious risks to human health. There were concerns that intensive rice production through excessive exploitation of land and water resources would create risks for long-term sustainability of both rice production and rural economies.

On the other hand, agricultural trade liberalisation facilitated rural electrification, emergence of co-operative societies and the establishment of new social relationships amongst the rural communities. It also facilitated the development of the rural non-farm sector through establishment of local markets, workshops for repairing agricultural equipment and machinery, rice mills and new transportation facilities derived from the use of LLPs.

In the final chapter of the thesis, the study reflects on how the findings in this study address the research question – how has agricultural trade liberalisation impacted on the welfare of rural households, and offers some policy recommendations on how the gains from agricultural trade liberalisation could be best enhanced to provide the greatest outcomes for the welfare of rural households.

CHAPTER TEN

Conclusions and Policy Recommendations

10.1 Conclusions

This PhD study set out to analyse the impact of agricultural trade liberalisation on the welfare of rural households in Bangladesh. The main research question was – "how has agricultural trade liberalisation impacted on the welfare of rural households in Bangladesh?"

1. From the review of empirical studies and analysis of data from the Bangladesh Bureau of Statistics for the period 1985-86 to 2005, and data from the field survey in 2010, it was established that agricultural trade liberalisation influenced the welfare of rural households in a variety of ways. Agricultural trade liberalisation invariably led to reduction in the government's control over agricultural inputs and opening up of the market for both local and international producers and suppliers. This provided rice farmers with access to cheaper inputs such as irrigation, fertilisers, pesticides and HYV seeds, and led to the technological transformation in rice production.
2. The technological transformation in agricultural production led to major structural changes in agriculture and the rural economy, leading to a substantial increase in productivity of rice. Average yields per hectare and total rice production increased significantly, leading to a substantial increase in the supply of rice in the domestic market which resulted in significant reductions in rice prices. Although both producer and consumer prices of rice decreased, the reduction in the producer price was greater than the reduction in the consumer price.
3. The rapid transformation of the agricultural sector, particularly rice production, significantly contributed to Bangladesh achieving self-sufficiency in food grains by the early 1990s. It was also a major contribution to the country's rapid economic (real GDP) growth, which averaged 4.2 percent per annum in the period 1985-86 to 2005.

4. Despite significant economic growth, the question remained as to what extent economic growth resulting from agricultural trade liberalisation influenced the welfare of rural households.
5. To help address this question this research undertook the case study of rice production to critically analyse how changes in production and prices of rice affected rural household welfare.
6. The key findings of the study were that there was a significant increase in total factor productivity growth of rice driven primarily by a cropping shift from local varieties to HYV. Consequently, there was also a reallocation of resources in favour of HYV-Boro. Farm households benefited directly from increased productivity of rice through greater production, and non-farm households benefited indirectly from price reduction, leading to an increase in their real income.

The study found that increased productivity and the subsequent reduction in both producer and consumer prices of rice generated differences in changes in the welfare of different groups of rural households. Findings of this study indicated that non-farm households gained more than farm households from the large reduction in consumer price. Farm households gained from the increase in productivity but experienced losses from producer price reduction. The two opposite forces – increase in productivity and reduction in producer price – offset the effects of each other, thereby affecting the welfare of farm households.

Findings of this study suggested that although rural households experienced a moderate to high increase in real income, non-farm households experienced a larger increase than farm households. Amongst the farm households, large and medium farmers gained the most and small farmers gained the least from the growth in real income, indicating that rich households experienced a much higher increase in real income than poor households – thereby adversely affecting the distribution of income and widening the income gap between rich and poor households. These findings demonstrated that while agricultural trade liberalisation benefited rural households generally, the benefits were not distributed equally and in fact, inequality increased amongst rural households. The growth in real income was not pro-poor and the reduction in poverty amongst the bottom quintiles was insignificant.

The study found that agricultural trade liberalisation contributed to the growth of the rural non-farm sector through backward and forward linkages with input and output markets. These linkages included the establishment and development of local dealerships for agricultural inputs (fertilisers, pesticides and HYV seeds); workshops for repairing agricultural equipment; establishment of rice mills in rural areas, thereby generating higher opportunities for employment and income in the rural economy. Rural non-farm households benefited from agricultural trade liberalisation through greater opportunities for employment and income, higher nominal wages derived from a higher demand for labour in the non-farm sector, and higher real wages resulting from lower consumer price of rice.

Agricultural trade liberalisation made chemical fertilisers and pesticides cheaper, encouraging their widespread use. The majority of rice farmers used fertilisers and pesticides without proper training and scientific knowledge, thereby exposing themselves to serious health hazards and causing damage to the environment in the form of loss of bio-diversity and environmental degradation.

10.2 Contribution to Knowledge

This study contributed to knowledge in a number of ways. Firstly, in the area of methodology, this study combined a number of mathematical, statistical, and econometric models and measurement techniques, thus using multiple models rather than a single model used in previous studies. This approach was in helping to overcome the shortcomings of single model approaches for analysing the multi-dimensional impacts of agricultural trade liberalisation on the welfare of rural households. Secondly, this study used household income and consumption separately for measuring welfare to overcome the shortcomings of previous studies that used either income or consumption as a measure of household welfare. Thirdly, it extended the Isik-Dikmelik (2006) model by separating household economic and non-economic characteristics (endowment) in analysing the determinants of household income and consumption. Fourthly, the study encountered limitations in the use of secondary data due to a lack of disaggregation. The aggregate data approach uses summaries and thus cuts out much variation, resulting in higher correlations than with disaggregated data. This study overcame this limitation by disaggregating household data using respective household groups' weight (percentage share) as the basis for disaggregation. Fifthly, this study mapped out gains and losses from agricultural trade liberalisation experienced by rural households through dividing them into two main groups – farm and non-farm households – and then it segregated farm households into four sub-groups namely: large farmers, medium farmers, small farmers and agricultural labourers. Sixthly, it critically examined the welfare of rural households through investigating the seasonal variation of rice price and the imperfection in the rice market for better understanding of the distributional consequences of agricultural trade liberalisation. Seventhly, this study went beyond economic impact of agricultural trade liberalisation through inclusion of environmental impact, changes in rural infrastructure, development of the rural non-farm sector (backward and forward linkages) in the analytical framework of understanding the welfare of rural households. Finally, it critically examined income distribution, inequality, and poverty in the general framework for analysing the impact of agricultural trade liberalisation on the welfare of rural households.

10.3 Recommendations and Policy Implications

While agricultural trade liberalisation had positive impacts on the welfare of rural households in Bangladesh, the policy was not effective in bringing about its full potential due to shortcomings associated with socio-economic factors and weak economic institutions. These shortcomings include market failure (market imperfection), weak macroeconomic policy, institutional weakness, and inadequate rural infrastructure. The study argues that the agricultural trade liberalisation policy fell short in improving income distribution amongst rural households and reducing inequality to bring about a larger reduction in poverty than that experienced by rural communities. The study pointed out that the agricultural trade liberalisation policy was not adequate to confer a benefit upon the poor households. It suggests that other complementary polices such as progressive income tax, income transfer to the poor in the form of tax reduction, food subsidy etc. are required to increase the effectiveness of the agricultural trade liberalisation policy for conferring benefits to the poor. Similarly, farm households experienced a smaller gain than non-farm households from this liberalisation process, suggesting that additional policies are required to transfer benefit to farm households because they are the driving force of the rural economy in Bangladesh. Furthermore, the agricultural trade liberalisation policy caused damage to the environment because of an increase in the inappropriate use of chemical fertilisers and pesticides in the post-liberalisation era.

Although agricultural trade liberalisation increased the productivity of rice, gains from this productivity-growth varied across different groups of rural communities. The rich gained more than the poor, resulting in greater inequality and an insignificant poverty reduction in the post-liberalisation era. Agricultural trade liberalisation encouraged rice production through wider use of new technology – a combination of irrigation-fertiliser-HYV seeds. However, the productivity-growth of rice started to fall, suggesting a requirement of technological innovation. Moreover, agricultural trade liberalisation created environmental problems. In these circumstances, the following policy implications and recommendations are considered significant to address issues related to agricultural trade liberalisation:

(a) The study found that agricultural trade liberalisation positively influenced the productivity-growth of rice immediately after trade liberalisation. The rice sub-sector experienced an increase in TFP-growth over the first decade in the post-liberalisation era, implying an increasing return to scale in rice production. However, TFP-growth of rice started to slow down after the first decade of high productivity growth. This slow-down in TFP-growth is attributed to technological contraction or non-improvement.

Recommendation: The TFP-growth is a multiplicative impact of technical efficiency change and technological change generated from the efficient use of inputs and an outward shift in production possibility frontier respectively. The study suggests that the government should invest in (1) research and development for technological innovation, and (2) human resource development through training and extension services for efficient use of inputs to improve TFP-growth in rice production.

(b) The study revealed how agricultural trade liberalisation impacted on prices of rice through increased productivity growth resulting from technological transformation, leading to a substantial decrease in both producer and consumer prices of rice. The decrease in the producer price was greater than that in the consumer price. As a result, farm households experienced a relatively small gain compared to non-farm households. Farm households constitute the majority of Bangladesh rural communities and contribute much to the rural economy. This finding indicates that some farmers may shift from rice to other agricultural or non-farm activities, thus jeopardising the country's self-sufficiency in food-grain production.

Recommendation: The study recommends the formulation of government policies to support farm households by means of income transfer such as tax reduction and production subsidy in order to avoid macroeconomic instability as a result of high food prices due to a shortage of rice production. A high food price will adversely affect the performance of economic growth.

(c) The study found that there is an excess of labour employed in rice cultivation, indicating wastage of productive resources in the form of under-employment or disguised unemployment. The study suggests that the removal of excess labour from rice cultivation could benefit the economy in three ways: reducing wastage of resources in the form of under-employment or disguised unemployment; increased efficiency in rice production through an increase in the marginal productivity of labour; and contribution to household income through excess labour gaining employment in other than rice cultivation.

Recommendation: The study recommends the formulation of government policies to generate employment and absorb the excess labour from rice cultivation. This policy may relate to providing training and loans to start businesses or training for employment in areas other than rice cultivation.

(d) The study identified market failure (imperfection) in the rice market in the form of controls over the rice market by syndicates of rice traders. They benefit from the rice market in two ways: rice trader syndicates buy rice at a lower producer price during the peak season and sell at a higher consumer price during the lean season. They manipulate the rice prices and play the role of middlemen in the rice market, thus exploiting both producers and consumers. The study also identified higher losses experienced by small farmers from this market imperfection as they mostly sold rice during the peak season at lower prices and bought rice during the lean season at higher prices.

Recommendation: The study recommends the formulation of government regulatory framework (in the form of enactment of rules and regulations) as a tool for market intervention to support small farmers and poor households. Similarly, the government should undertake the following measures: (1) encourage the promotion of small farmers' cooperatives with institutional supports to have a stronger voice in the rice market; (2) provide storage facilities where small farmers and cooperatives could store excess grain both for family consumption and trade; (3) introduce producer-guaranteed prices to support small farmers; and (4) offer preferential purchases by government at producer-guaranteed prices, or through farmers' cooperatives.

(e) Although agricultural trade liberalisation benefited rural households through increased productivity and decreased prices of rice, the productivity growth and changes in prices of rice resulted in an increase in inequality amongst the different groups of rural households. The rich gained more than the poor from this process and the reduction in poverty was insignificant. The study estimated that, even if inequality were held constant at the 1985-86 level, the growth that rural households experienced could easily have reduced poverty to zero level in 2005. However, in reality, poverty remained at a high level – more than 40 percent of the population lived in poverty in 2005.

Recommendation: Poverty reduction is a big challenge for the government, because of the increase in inequality along with economic growth. Policies to reduce inequality could include a progressive income tax to impose higher tax on higher income and income transfer to the poor.

The current liberal income tax system is not adequate to reduce inequality as it favours the rich (TK165000 or below: nil; TK165001-275000: 10 percent; TK275001-325000: 15 percent; TK325001-375000: 20 percent; and TK375001+: 25 percent income tax whereas per capita income was only TK 53000 in 2010-11) (NBR, 2011: 1). Therefore, the government should also reform the income tax structure, lowering the taxable income threshold to the level of per capital income, increasing tax rates more progressively than existing levels, and raising the highest tax rate to 40 percent of taxable income. Similarly, the government should ensure efficient transfer of these benefits to the poor through subsidised food, health care, and education to reduce inequality.

(f) The study revealed that cheaper agricultural inputs such as chemical fertilisers and pesticides were causing damage to the environment in the form of pollution, loss of bio-diversity, loss of soil fertility, and ecological imbalance.

The main cause of this damage was that the farmers apply chemical fertilisers and pesticides to rice fields without appropriate scientific knowledge.

Recommendation: A sound environmental policy is urgently needed to address the environmental issues arising from agricultural trade liberalisation in order to maintain a balance between economic growth and environmental protection. The government should formulate policies and programmes to provide farmers with training and scientific knowledge about the application of chemical fertilisers and pesticides to rice fields for protecting the environment and ensuring economic growth.

(g) The study identified that small farmers have no storage facilities other than their home, which is inappropriate for storage of rice due to wet weather, rats, insects and other pests.

Recommendation: This study suggests that the government should build storage facilities for farmers, and encourage and support farmers' cooperatives to manage these facilities.

(h) Agricultural trade liberalisation and deregulation policies are focused mostly on input markets, which are on the supply side of the economy. Agriculture continues to suffer from imperfection in the market and controls by rice traders over output pricing, marketing, and distribution. Reduced expansion of pace of domestic demand for rice compared to its production (supply) and inadequate export orientation (restriction on rice exports) continue to limit the incentives for production.

Recommendation: The government should formulate policies and measures to deregulate output markets and boost domestic demand, along with putting initiatives in place to remove restrictions from rice exports.

As discussed above, the study argues that the impacts of agricultural trade liberalisation on the welfare of rural households depend not only on liberalisation itself but also require other complementary reforms in non-trade areas. In addition, further reforms are needed in the domestic rice markets as well as reforms in trade policies focusing on institutional changes.

10.4 Areas for Further Study

The study identified a shift from net buyer to net seller households. This shift may be attributed to increased productivity of rice because some small farmers became more productive, thus transforming from net buyers into net sellers in the post-liberalisation period. Similarly, it was found that some landowner households became landless in the post-liberalisation period. However, this PhD study could not trace such changes because a longitudinal study is required to trace household life cycle.

Agricultural trade liberalisation made chemical fertilisers and pesticides cheaper, causing a significant increase in the use of these inputs in the post-liberalisation era. The study revealed that farmers applied chemical fertilisers and pesticides to rice fields on the basis of their knowledge acquired through experience and from fellow farmers – not based on scientific knowledge acquired through formal education and training. Inappropriate use of chemical fertilisers and pesticides could have adverse impacts on human health. However, it was not possible to identify and estimate these impacts leaving a significant gap of knowledge. An epidemiological study would address this gap.

The focus of this study was only on the welfare of rural households and excluded urban households. Therefore, a study focusing on both rural and urban households would provide a more complete picture of the impact of agricultural trade liberalisation.

Similarly, the study was limited only to rice and changes in the productivity and price of rice. Future studies could look more broadly at all agricultural production in order to present a wider picture of the impact of agricultural trade liberalisation.

This study identified changes in socio-economic relationships in the post-liberalisation period. These changes include co-operative based ownership, rural physical infrastructure, road and transportation facilities, establishment of new rural markets, rural electrification, and development of the non-farm sector. These changes could be analysed further using the *community capitals framework*, which was beyond the scope of this study. Future studies could use this framework to analyse the impact of agricultural trade liberalisation on the welfare of rural communities in Bangladesh.

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Appendix

A1: Ethics Application approval letter from the AUTEC

MEMORANDUM

Auckland University of Technology Ethics Committee (AUTEC)

To: Love Chile

From: Madeline Banda Executive Secretary, AUTEC

Date: 4 February 2010

Subject: Ethics Application Number 09/285 A critical analysis of the impact of agricultural trade liberalisation on the welfare of rural communities in Bangladesh.

Dear Love

Thank you for providing written evidence as requested. I am pleased to advise that it satisfies the points raised by the Auckland University of Technology Ethics Committee (AUTEC) at their meeting on 14 December 2009 and that I have approved your ethics application. This delegated approval is made in accordance with section 5.3.2.3 of AUTEC's *Applying for Ethics Approval: Guidelines and Procedures* and is subject to endorsement at AUTEC's meeting on 8 March 2010.

Your ethics application is approved for a period of three years until 4 February 2013.

I advise that as part of the ethics approval process, you are required to submit the following to AUTEC:

- A brief annual progress report using form EA2, which is available online through *http://www.aut.ac.nz/research/research-ethics*. When necessary this form may also be used to request an extension of the approval at least one month prior to its expiry on 4 February 2013;
- A brief report on the status of the project using form EA3, which is available online through *http://www.aut.ac.nz/research/research-ethics*. This report is to be submitted either when the approval expires on 4 February 2013 or on completion of the project, whichever comes sooner;

It is a condition of approval that AUTEC is notified of any adverse events or if the research does not commence. AUTEC approval needs to be sought for any alteration to the research, including any alteration of or addition to any documents that are provided to participants. You are reminded that, as applicant, you are responsible for ensuring that research undertaken under this approval occurs within the parameters outlined in the approved application.

Please note that AUTEC grants ethical approval only. If you require management approval from an institution or organisation for your research, then you will need to make the arrangements necessary to obtain this. Also, if your research is undertaken within a jurisdiction outside New Zealand, you will need to make the arrangements necessary to meet the legal and ethical requirements that apply within that jurisdiction.

When communicating with us about this application, we ask that you use the application number and study title to enable us to provide you with prompt service. Should you have any further enquiries regarding this matter, you are welcome to contact Charles Grinter, Ethics Coordinator, by email at ethics@aut.ac.nz or by telephone on 921 9999 at extension 8860.

On behalf of the AUTEC and myself, I wish you success with your research and look forward to reading about it in your reports.

Yours sincerely

Madeline Banda

Executive Secretary
Auckland University of Technology Ethics Committee

Cc: Dayal Talukder dktalukder@hotmail.com

A2: Structured interview questionnaire: Part A, Farm Household

Field Survey 2009/2010

STRUCTURED INTERVIEW QUESTIONNAIRE
Part A
Farm Household

Information about the Research Project

Research Project:	A Critical Analysis of the Impact of Agricultural Trade Liberalisation on the Welfare of Rural Communities in Bangladesh
Project Supervisor:	Dr Love Chile
Researcher's Name:	Dayal Talukder
Department:	Institute of Public Policy
Faculty:	Applied Humanities
University:	Auckland University of Technology, Auckland, New Zealand

Date of Interview: ....Day......................Month.............................Year

Statement: This structured interview questionnaire will be answered by household head or a senior person of the household who has access to information of all household members. The researcher will conduct this structured interview through asking participants the questions and writing their answers. If the participant does not have information about all members of the household, the participant will not be requested to participate in the research.

Section One: Basic household information

Household Location
District: Comilla
Upazila: Sadar Upazila
Union:
Village:

Demographic information
Total number of people in the household:

Age and sex distribution
(Head = head of household)

Member	Age range				Sex	
	0-4	5-14	15-55	55+	Male	Female
1 (Head)						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						

Household involvement with agriculture

Farmer	Agricultural labourer

Land ownership: total land

Total owned land (*acre*)

Educational information

Member	Adult literacy (15+)			Ever attended		Highest level attended			
	literate (can read, write and do basic maths)	illiterate	na (under 15 year)	school	na (under 3 year	primary	secondary	tertiary	adult literacy programme
1 (Head)									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									

Housing characteristics

Ownership of house

Owned	Rented	Other (please specify)	Number of rooms/huts

House building materials (answers will be written through questions and observation)

Main materials of the floor		Main material of the roof		Main material of the walls	
Materials	Floor	Materials	Roof	Materials	Walls
Earth/sand		Thatch/ sod/leaf		Cane/palm/trunks/Leaf/jute stick/sod	
Wood plank		Rustic mat/plastic		Dried mud	
Bamboo		Sheet/polythine		Bamboo/bamboo with mud	
Polished wood		Palm/bamboo		Tin sheet	
Ceramic tiles		Metal (tin)		Finished walls	
Cement		Wood		Cement/cement block	
Carpet/mat		Ceramic tiles		Bricks	
Other (please specify		Cement and concrete		Other (please *specify*)	
		Other (please specify)			

Section Two: Income, consumption, expenditure and employment

Sources of household monthly income

Agriculture		Non-agriculture	
Source	Taka	Source	Taka
Rice		Wage/salary	
Wheat		Rent	
Other cereals		Trading and business	
Pulses		Cottage industry	
Vegetables		Remittance	
Fruit		Other (please specify)	
Other crops			
Poultry			
Dairy			
Fishing			
Other (please specify)			

Current value of assets

Assets	Value (taka)
House	
Household contents	
Farm assets (including forestry, dairy, poultry and fishery)	
Land	
Monetary assets	
Capital goods	
Others (please specify)	

Household consumption

Monthly food consumption			
Food item	Purchased (%)	Own produced (%)	Received from others (%)
Rice			
Wheat			
Maize and other cereals			
Vegetables			
fruit			
meat			
egg			
fish			
pulses			
other food			
Monthly non-food expenditure			
Non-food items	Purchased (%)	Own produced (%)	Received from others (%)
Clothing and footwear			
Housing and house rent			
Fuel and lighting			
Household effects			
Traditional ceremonies			
Transportations			
Education			
Others (please specify)			

Household monthly expenditure on food and non-food items

Monthly food expenditure	Taka	monthly non-food expenditure	Taka
Rice		Clothing and footwear	
Other foods		Housing and house rent	
		Fuel and lighting	
		Household effects	
		Traditional ceremonies	
		Transportations	
		Education	
		Others (please specify)	

If you get Taka 50000 (equivalent to NZD1000) how do you like to spend them?

1.
2.
3.
4.
5

Employment

Types and nature of employment

Household member	Employment type							Nature of Employment			
	Self-employed	Government	NGOs	Farm	Non-farm	Unemployed	na (under 15 or over 55)	Full-time	Part-time	Seasonal	Casual
1 (Head)											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											

Wage category and average wage (main income earner of household)

Wage category				Average wage (taka)	Comments
Monthly	Weakly	Daily	Hourly		Main incomer earner may be head or other member of household

Section Three: Farm activities, input markets and rice cultivation

Total land size for agricultural activities

Owned land size (*acre*)	Leased land size (*acre*)	
	From government	Private land lords

Lease tenure and mode of lease payment

Lease tenure			Mode of lease payment			
Every year	2-5 years	5 years +	Cash payment	Kinds/crops	Share cropping	Others (please specify)

Land use for rice cultivation and other farming activities

Land size and proportion	Farming activities							
	Rice cultivation	Vegetables and pulse	Fruit	Other crop	Other farm activities (poultry, dairy, fishery etc)	Rice, vegetables and pulses	Rice and other crops	Other (please specify)
Size (acre)								
Proportion (%)								

Size of land used for different rice crops cultivation (round the year)

Size and proportion	Rice crops						
	Aus, amon and boro	Aus and amon	Aus and boro	Amon and boro	Aus only	Amon only	Boro only
Size (acre)							
Proportion (%)							

Do you like to continue rice production in next ten years?

Yes	No

Please explain the reasons:

1.
2.
3.
4.
5.

Rice share cropping

Inputs/items	Land owner provide (%)	Farmer provide (%)	Farmer's crop share (%)
Seeds			
Fertilizers			
Irrigation			
Ploughing			
Pesticides			
Others (please specify)			

Land preparation for rice cultivation

Land preparation for rice cultivation: by methods

Methods used			
Bullock	Use spade	tractor	Others (please specify)

Days used to prepare land for rice cultivation

Rice crops	Rice varieties	Methods used			
		Bullock	Spade	Tractor	others
Aus (wet and dry season mix)	Local				
	HYV				
Amon (wet season)	Local				
	HYV				
Boro (dry season)	Local				
	HYV				

Average cost of per day hire for land preparation

Rice crops	Rice varieties	Average cost per day (taka)			
		Bullock	Spade	Tractor	others
Aus (wet and dry season mix)	Local				
	HYV				
Amon (wet season)	Local				
	HYV				
Boro (dry season)	Local				
	HYV				

Rice plantation

Rice plantation: by methods

Manual labour	Machine	Others (please specify)

Days used for rice plantation

Rice crops	Rice varieties	Methods		
		Manual labour	Machine	Others (please specify)
Aus (wet and dry seasons mix)	Local			
	HYV			
Amon (wet season)	Local			
	HYV			
Boro (dry season)	Local			
	HYV			

Average cost of per day hire for rice plantation

Rice crops	Rice varieties	Methods		
		Manual labour	Machine	Others (please specify)
Aus (wet and dry seasons mix)	Local			
	HYV			
Amon (wet season)	Local			
	HYV			
Boro (dry season)	Local			
	HYV			

Weeds cleaning in the rice fields

Weeds cleaning in the rice fields: by methods

Methods used			
Manual labour	With manual machine	With powered machine	Others (please specify)

Days used for weeds cleaning in rice fields

Rice crops	Rice varieties	Methods used			
		Manual labour	With manual machine	With powered machine	Others (please specify)
Aus (wet and dry season mix)	Local				
	HYV				
Amon (wet season)	Local				
	HYV				
Boro (dry season)	Local				
	HYV				

Average cost of per day hire for weeds cleaning in rice fields

Rice crops	Rice varieties	Average cost per day (taka)			
		Manual labour	Manual machine	powered machine	Others (please specify)
Aus (wet and dry season mix)	Local				
	HYV				
Amon (wet season)	Local				
	HYV				
Boro (dry season)	Local				
	HYV				

Harvesting rice crops

Harvesting rice crops: by methods

Methods used			
Manual labour	With manual machine	With powered machine	Others (please specify)

Days used for harvesting in rice crops

Rice crops	Rice varieties	Methods used			
		Manual labour	With manual machine	With powered machine	Others (please specify)
Aus (wet and dry season mix)	Local				
	HYV				
Amon (wet season)	Local				
	HYV				
Boro (dry season)	Local				
	HYV				

Average cost of per day hire for rice crops

Rice crops	Rice varieties	Average cost per day (taka)			
		Manual labour	With manual machine	With powered machine	Others (please specify)
Aus (wet and dry season mix)	Local				
	HYV				
Amon (wet season)	Local				
	HYV				
Boro (dry season)	Local				
	HYV				

Use of inputs for rice production

Rice seeds: types and collection methods

Rice Crops	Type of rice seeds	Amount (kg)	Rice seeds collection methods (%)				
			Own seeds	Purchase from dealers	Purchase from farmers	Take as a loan	Others (please specify)
Aus	Local						
	HYV						
Amon	Local						
	HYV						
Boro	Local						
	HYV						

Other inputs: use of other inputs for rice production

Rice crops	Rice Variety	INPUTS													
		Irrigation					Fertilizers						Pesticides		
		LLP	DTW	STW	canal	Tradition	Urea	TSP	MP	Gypsum	Organic	Others	Insecticide	Fungicides	Herbicides
Aus	Local														
	HYV														
Amon	Local														
	HYV														
Boro	Local														
	HYV														

Note: LLP = low lift pump, DTW = deep tube-well, STW = shallow tube-well, traditional = dam, manual lifting etc
TSP = triple super phosphate, MP = mono-phosphate

Yearly expenditure on inputs for rice production (taka)

Rice crops	Rice Variety	INPUTS			
		Rice seeds	Irrigation	Fertilizers	Pesticides
Aus	Local				
	HYV				
Amon	Local				
	HYV				
Boro	Local				
	HYV				

Views about the prices of inputs

Inputs	Views				
	Very high	High	Moderate/reasonable	Low	Very low
Rice seeds					
Irrigations					
Fertilizers					
Pesticides					

On what basis do you use of chemical fertilizers and pesticides?

Inputs	Basis of fertilizers and pesticides use				
	Knowledge acquired through formal training	Knowledge acquired Through experience	Knowledge acquired from other farmers	Just guess	No basis
Fertilizers					
Pesticides					

Use of Labour for rice production and average wage

Rice crop	Rice variety	Types of labour			Average wage of hired labour per day (taka)
		Own/family	Hired	Other (pls specify)	
Aus	Local				
	HYV				
Amon	Local				
	HYV				
Boro	Local				
	HYV				

Section Four: Involvement with rice market

Rice production, selling and purchase per year

Rice crops	Rice variety	Production (100 kg bag)	Proportion of rice sell to total rice production (%)	Proportion of rice purchase to total rice production (%)
Aus	Local			
	HYV			
Amon	Local			
	HYV			
Boro	Local			
	HYV			

Prices of rice

Rice crops	Rice variety	Selling price (Taka/kg)								Purchase price (Taka/kg)							
		10-14	15-19	20-24	25-29	30-34	35-39	40-44	45+	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45+
Aus	Local																
	HYV																
Amon	Local																
	HYV																
Boro	Local																
	HYV																

Rice marketing: when do you sell and buy rice?

Rice crops	Rice variety	Sell by seasons		Purchase by seasons	
		Peak (harvest season)	Lean season	Peak (harvest season)	Lean season
Aus	Local				
	HYV				
Amon	Local				
	HYV				
Boro	Local				
	HYV				

Use of by-products of rice

Use of by-product of rice									
Use of Stubble					Husk				
Animal feed	Fuel for cocking	Make organic fertilizers	Leave in the rice field	Others (pls specify)	Animal feed	Fuel for cocking	Make organic fertilizer	Leave at rice mill (no use)	Other (pls specify)

Section Five: Natural resource and environment

5.1 Do you think farmers are engaging too much land for rice cultivation?

Yes	No	Not sure

Please explain:
1.
2.
3.
4.
5.

What are your sources of drinking water?

Sources of drinking water					
River	Wells	Ponds	Tube-wells	Ring-wells	Others (pls specify)

Do you think the use of water for irrigation is affecting the availability and quality of drinking water?

Yes	No	Not sure

Please explain:
1.
2.
3.
4.
5.

Do you think irrigation in the rice field causing damage to environment?

Yes	No	Not sure

Please explain:
1.
2.
3.
4.
5.

Do you think the use of chemical fertilizers in rice production causing damage to environment?

Yes	No	Not sure

Please explain:
1.
2.
3.
4.
5.

Do you think the use of pesticides in the rice field causing damage to environment?

Yes	No	Not sure

Please explain:
1.
2.
3.
4.
5.

Section Six: Transportation and rural infrastructure

What modes of transportation facilities do you use in your village?

Mode of transports					
Walk	Bicycle	Rickshaws	Auto-rickshaw	Bus	Others (pls specify)

What mode of transport do you use to go to your Upazila headquarter?

Mode of transports					
Walk	Bicycle	Rickshaws	Auto-rickshaw	Bus	Others (pls specify)

Does your village have roads for truck, bus, and cars for transportations?

Yes	No

What mode of transport do you use to carry goods to and from shopping centres?

	Mode of transports used to carry goods					
Carry physically	Carry by animal carts	Rickshaws	Auto-rickshaw	Bus	Truck	Others (pls specify)

In what ways has transport and infrastructure changed over last 5 years?

New road developed			Existing road improved			Number of transport increased			Availability of public transportation increased		
Yes	No	Not sure	Yes	No	Not sure	Yes	No	Not sure	Yes	No	Not sure

Communication: which of the following modes of communication do you use?

Mode of communication

Telephone		Mobile phone		Radio			TV colour		TV black and white		Computer		Internet network	
Yes	No	Yes	No	Yes	No		Yes	No	Yes	No	Yes	No	Yes	No

How frequently do you use them?

Mode	Frequency			
	Monthly	Daily	Weekly	More than once everyday
Telephone				
Mobile phone				
Radio				
TV				
Internet				

Storage facilities: do you have storage facilities for rice?

Types of storage facilities			
Private		Public	Other (please specify)
Own-house	Other private storage		

Where do you store rice?

Storage type				
	Own-house	Other private storage	Public	Others (pls specify)
% used				

Thank you for your time. Please do not hesitate to contact me if you require further information regarding this project.
Email address: dktalukder@hotmail.com

A3: Structured interview questionnaire: Part B, Non-farm Household

Field Survey 2009/2010

STRUCTURED INTERVIEW QUESTIONNAIRE
Part B
Non-farm Household

Information about the Research Project

Research Project:	A Critical Analysis of the Impact of Agricultural Trade Liberalisation on the Welfare of Rural Communities in Bangladesh
Project Supervisor:	Dr Love Chile
Researcher's Name:	Dayal Talukder
Department:	Institute of Public Policy
Faculty:	Applied Humanities
University:	Auckland University of Technology, Auckland, New Zealand

Date of Interview: ....Day......................Month.............................Year

Statement: This structured interview questionnaire will be answered by household head or a senior person of the household who has access to information of all household members. The researcher will conduct this structured interview through asking participants the questions and writing their answers. If the participant does not have information about all members of the household, the participant will not be requested to participate in the research.

Section One: Basic household information

Household Location

District: Comilla
Upazila: Sadar Upazila
Union:
Village:

Occupational information (occupation of main income earner of household)

Name of occupation	
Government civil service	
NGO worker	
Trader	
Industrialist	
Transport worker	
Labourer	
Other (please specify)	

Demographic information

Total number of people in the household:

Age and sex distribution

(Head = head of household)

Member	Age range				Sex	
	0-4	5-14	15-55	55+	Male	Female
1 (Head)						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

Employment

Types and nature of employment

Household member	Employment type							Nature of Employment			
	Self-employed	Government	NGOs	Farm	Non-farm	Unemployed	na (under 15 or over 55)	Full-time	Part-time	Seasonal	Casual
1 (Head)											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											

Wage category and average wage (main income earner of household)

Wage category				Average wage (taka)	Comments
Monthly	Weakly	Daily	Hourly		Main incomer earner may be head or other member of household

Educational information

Member	Adult literacy (15+)			Ever attended		Highest level attended			
	literate (can read, write and do basic maths)	illiterate	na (under 15 year)	school	na (under 3 year	primary	secondary	tertiary	adult literacy programme
1 (Head)									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

Housing characteristics

Ownership of house

Owned	Rented	Other (please specify)	Number of rooms/huts

House building materials (answers will be written through questions and observation)

Main materials of the floor		Main material of the roof		Main material of the walls	
Materials	Floor	Materials	Roof	Materials	Walls
Earth/sand		Thatch/ sod/leaf		Cane/palm/trunks/Leaf/jute stick/sod	
Wood plank		Rustic mat/plastic		Dried mud	
Bamboo		Sheet/polythine		Bamboo/bamboo with mud	
Polished wood		Palm/bamboo		Tin sheet	
Ceramic tiles		Metal (tin)		Finished walls	
Cement		Wood		Cement/cement block	
Carpet/mat		Ceramic tiles		Bricks	
Other (please specify		Cement and concrete		Other (please *specify*)	
		Other (please specify)			

Land ownership: total land

Owned land size (*acre*)

Current value of assets

Assets	Value (taka)
House	
Household contents	
Farm assets (including forestry, dairy, poultry and fishery)	
Land	
Monetary assets	
Capital goods	
Others (please specify)	

Section Two: Income, consumption, expenditure and employment

Sources of household monthly income

Non-agriculture		Agriculture	
Source	Taka	Source	Taka
Wage/salary		Rice	
Rent		Wheat	
Trading and business		Other cereals	
Cottage industry		Pulses	
Remittance		Vegetables	
Other (please specify)		Fruit	
		Other crops	
		Poultry	
		Dairy	
		Fishing	
		Other (please specify)	

Household monthly expenditure on food and non-food items

Monthly food expenditure	Taka	monthly non-food expenditure	Taka
Rice		Clothing and footwear	
Other foods		Housing and house rent	
		Fuel and lighting	
		Household effects	
		Traditional ceremonies	
		Transportations	
		Education	
		Others (please specify)	

If you get Taka 50000 (equivalent to NZD1000) how do you like to spend them?
1.
2.
3.
4.
5.

Household consumption

Monthly food consumption			
Food item	Purchased (%)	Own produced (%)	Received from others (%)
Rice			
Wheat			
Maize and other cereals			
Vegetables			
fruit			
meat			
egg			
fish			
pulses			
other food			
Monthly non-food expenditure			
Non-food items	Purchased (%)	Own produced (%)	Received from others (%)
Clothing and footwear			
Housing and house rent			
Fuel and lighting			
Household effects			
Traditional ceremonies			
Transportations			
Education			
Others (please specify)			

Section Three: Involvement with rice market

Rice production, selling and purchase per year

Rice crops	Rice variety	Production (100 kg bag)	Proportion of rice sell to total rice production (%)	Proportion of rice purchase to total rice consumption (%)
Aus	Local			
	HYV			
Amon	Local			
	HYV			
Boro	Local			
	HYV			

Prices of rice

Rice crops	Rice variety	Selling price (Taka/kg)								Purchase price (Taka/kg)							
		10-14	15-19	20-24	25-29	30-34	35-39	40-44	45+	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45+
Aus	Local																
	HYV																
Amon	Local																
	HYV																
Boro	Local																
	HYV																

Rice marketing: when do you sell and buy rice?

Rice crops	Rice variety	Sell by seasons		Purchase by seasons	
		Peak (harvest season)	Lean season	Peak (harvest season)	Lean season
Aus	Local				
	HYV				
Amon	Local				
	HYV				
Boro	Local				
	HYV				

Rice trader (if applicable)

Type of rice trader

Wholesale trader	Retailer

How frequently do you buy and sell rice?

Frequency	Buy	Sell
Daily		
Weekly		
Monthly		
Seasonally		
Other (please specify		

Where do you sell and buy rice?

Place	Buy	Sell
Home		
Temporary village markets		
Permanent village markets		
Union markets		
Upazila markets		
District markets		
Other (please specify)		

Section Four: Involvement with non-farm activities

Household Involvement with non-farm activities related to rice

Related to Rice Input Markets		Related to Rice Output Markets	
Type of activities	% of total work	Type of activities	% of total work
Seeds dealer		Rice miller	
Fertilizer dealer		Rice retailer	
Pesticide dealer		Rice wholesale trader	
Irrigation equipment dealer		Others (pls specify)	
Mechanic and repair worker			
Others (pls specify)			

Household Involvement with major non-farms activities other than rice markets

Name of activities	% of total work

Section Five: Natural resource and environment

Do you think farmers are engaging too much land for rice cultivation?

Yes	No	Not sure

Please explain:
1.
2.
3.
4.
5.

What are your sources of drinking water?

Sources of drinking water					
River	Wells	Ponds	Tube-wells	Ring-wells	Others (pls specify)

Do you think the use of water for irrigation is affecting the availability and quality of drinking water?

Yes	No	Not sure

Please explain:
1.
2.
3.
4.
5.

Do you think irrigation in the rice field causing damage to environment?

Yes	No	Not sure

Please explain:
1.
2.
3.
4.
5.

Do you think the use of chemical fertilizers in rice production causing damage to environment?

Yes	No	Not sure

Please explain:
1.
2.
3.
4.
5.

Do you think the use of pesticides in the rice field causing damage to environment?

Yes	No	Not sure

Please explain:
1.
2.
3.
4.
5.

Section Six: Transportation and rural infrastructure

What modes of transportation facilities do you use in your village?

Mode of transports					
Walk	Bicycle	Rickshaws	Auto-rickshaw	Bus	Others (pls specify)

What mode of transport do you use to go to your Upazila headquarter?

Mode of transports					
Walk	Bicycle	Rickshaws	Auto-rickshaw	Bus	Others (pls specify)

Does your village have roads for truck, bus, and cars for transportations?

Yes	No

What mode of transport do you use to carry goods to and from shopping centres?

	Mode of transports used to carry goods					
Carry physically	Carry by animal carts	Rickshaws	Auto-rickshaw	Bus	Truck	Others (pls specify)

In what ways has transport and infrastructure changed over last 5 years?

New road developed			Existing road improved			Number of transport increased			Availability of public transportation increased		
Yes	No	Not sure	Yes	No	Not sure	Yes	No	Not sure	Yes	No	Not sure

Communication: which of the following modes of communication do you use?

Mode of communication														
Telephone		Mobile phone		Radio			TV colour		TV black and white		Computer		Internet network	
Yes	No	Yes	No	Yes	No		Yes	No	Yes	No	Yes	No	Yes	No

How frequently do you use them?

Mode	Frequency			
	Monthly	Daily	Weekly	More than once everyday
Telephone				
Mobile phone				
Radio				
TV				
Internet				

Storage facilities: do you have storage facilities for rice?

Types of storage facilities			
Private		Public	Other (please specify)
Own-house	Other private storage		

Where do you store rice?

Storage type				
	Own-house	Other private storage	Public	Others (pls specify)
% used				

Thank you for your time. Please do not hesitate to contact me if you require further information regarding this project.
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