

## Assessing Determinants of Income of Rural Households in Bangladesh: A Regression Analysis

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*The purpose of this study is to investigate the determinants of income and growth in income of rural households in Bangladesh in the post-liberalisation era. Using data mainly from secondary sources, the study applied the ordinary least square (OLS) regression models to assess the determinants. The determinants were justified based on both initial (1985-86) and current (2005) endowments (household characteristics) for a comparative analysis. The study used both economic and non-economic characteristics simultaneously for considering their joint effects on household income. The OLS regression models revealed that household size was the only non-economic factor that was statistically significant and positive determinant of household income in both 1985-86 and 2005. Household size was the largest positive determinant and small farmer dummy was the largest negative determinant of income in 1985-86. Similarly, household size was the largest positive determinant and farm-household dummy variable was the largest negative determinant of income in 2005. Although rice is the staple food in Bangladesh, the 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 income. Considering initial endowments, household land area was the largest positive determinant and share of income from wage-salary was the largest negative determinant of income-growth in 1985-86. Similarly, considering current endowments, change in share of income from house rent was the largest positive contributor and share of income from rice was the largest negative contributor to growth in 2005. The share of income from rice was positive determinant considering the current year endowments and was not statistically significant with the base year endowments. While the share of agriculture income was a positive determinant of household income in both years, the magnitude of its influence was very insignificant in 2005. This study suggests that an increase in productivity of rice did not influence in determining income and growth in income of rural households in the post-liberalisation era, implying the requirement for the government policy interventions to support farm households for maintaining food security and price stability in the economy.*

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### 1. Introduction

Bangladesh is an agricultural economy. 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 contributed around 20 percent to gross domestic product (GDP) and employed more than 60 percent of the total labour force of the economy in 2010 (Ministry of Finance, 2012; World Bank, 2011a, 2011b).

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The economy went through a series of deregulation and agricultural trade liberalisation measures in the late 1980s and early 1990s with a view to increasing productivity in agriculture and achieving self-sufficiency in food-grain production. 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; Moazzem *et al.*, 2012: 9; Salim and Hossain, 2006: 2569). Agricultural trade liberalisation generated significant impacts on major structural reforms and technological transformation in rice production, enabling the country to achieve self-sufficiency in food-grain production in the early 1990s (Ahmed and Sattar, 2004: 19; Faroque *et al.*, 2013: 2; Islam and Habib, 2007: 4; Klytchnikova and Diop, 2006: 3).

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, 2007: 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 determinants of income (welfare) of rural households in Bangladesh? Therefore, the focus of this study is to examine the determinants of income and growth in income in the post-liberalisation era.

Although other factors might also have affected the growth in real income of rural households, agricultural trade liberalisation was the most important policy reform because of households' critical dependence on rice in terms of both income and consumption. The study assumed rice as the representative of agriculture, thereby, considering changes in the rice price to analyse the impact of agricultural trade liberalisation on income 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.

Bangladesh was a large country in terms of the size of its population (164 million) with a very high density of 1246 people per sq km in 2009. However, it was a very small economy in terms of gross domestic product (GDP) (89.38 billion US dollars) and gross national income (GNI) per capita (590 US dollars) in the same year (Ministry of Finance, 2012; World Bank, 2011a, 2011b). Agriculture plays an important role in supplying food as well as in maintaining food security of this very large and fast-growing population. The food security and self-sufficiency in food grain production of the economy depends mainly on how agricultural trade liberalisation impacted income of rice farmers (farm households) in the post-liberalisation era and how they would response to rice production in the future. Therefore, this study is intended to examine the determinants of income and growth in income of rural households in the post-liberalisation era with a view to suggesting a policy

framework for the government to cope with food security and food production issues in the future.

The following sections include agricultural trade liberalisation scenarios in Bangladesh, literature review, methodology and research design, result discussion and analysis, and conclusion.

## **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, irrigation equipment and all other agricultural inputs (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, 2009: 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).

### 3. Literature Review

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 through technological transformation and productivity improvement 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 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).

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.

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 *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 rural households. 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).

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 the TFP must increase faster than food prices decrease for farm profitability to rise and for poor consumers to benefit from lower food prices.

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 income distribution 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).

Many studies have attempted to shed light on productivity of agriculture and income distribution in the rural economy. Some of these major studies on this effect include: Rice Price Stabilization in Bangladesh: An Analysis of Policy Options (Dorosh and Shahabuddin, 2002); Trade Liberalisation and the Crop Sector in Bangladesh (Hossain and Deb, 2003); Poverty Alleviation Through Agriculture and Rural Development in Bangladesh (Hossain, 2004); 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); Impact of Shallow Tube-wells and Boro Rice on Food Security in Bangladesh (Hossain, 2009); Evaluation of Rice Markets Integration in Bangladesh (Hossain and Verbeke, 2010); and Welfare Impact of Policy Interventions in the Foodgrain Markets in Bangladesh (Alam *et al.*, 2011). However, these studies did not specifically attempt to examine the determinants of income and growth in real income of rural households (distributional consequences) in the post-liberalisation era, which is the main focus of this study.

### **3. Methodology and Research Design**

#### **3.1 Data and Post-liberalisation Period**

The study used secondary data on household income mainly from two household surveys of the Bangladesh Bureau of Statistics (BBS) including *Household Income and Expenditure Survey (HHIES) 2005* (BBS, 2007), and *Household Expenditure Surveys (HHES) 1985-86* (BBS, 1988). It has selected 1985-86 as a the base year because of availability of data as well as the substantial agricultural trade liberalisation in the late 1980s. Similarly, it has selected 2005 as the current year due to availability of the latest household survey data. Therefore, changes in household income is measured using data of *HHES 1985-86* as the base year and data of *HHIES 2005* as the current year.

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, 2007) 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.

The study has also conducted a *Data Exploratory Analysis* to identify outliers. Two outliers were found in the data set of HHES 1985-86 and these outliers were dropped from this data set. However, no outlier was found with the data set of HHIES 2005.

The study also used primary data (Household Survey 2010, conducted by the authors) as complementary to secondary data.

### **Theoretical Framework: Welfare Analysis and Its Dimensions**

The study used income to measure economic welfare, as it capture the means by which households can achieve welfare (Strengmann-Kuhn, 2000: 2; Wagle, 2007: 75). In most empirical studies, income is the indicator used for household welfare and resources (Wagle, 2007: 75). This study also used income to analyse household welfare (Strengmann-Kuhn, 2000: 8).

The study investigated the changes in welfare of rural households. Here the changes in welfare were measured through the changes in determinants of income in the post-liberalisation era. 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 their real income. The welfare function may differ across the rural households and across circumstances, indicating that the same amount of real income may produce different levels of welfare. Thus, the welfare function depends not only on the real income but in some cases also on age, health status, employment status and other socio-economic factors. Therefore, the study considered both economic and non-economic characteristics of household in determining household welfare.



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.

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

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,  $\mathbf{P}$  is the price vector of commodities consumed, and  $\pi$  is the household's profits from farming or other family business. Since profits are maximised,  $\pi$  is assumed as the value of a profit function,  $n(\mathbf{p}, \mathbf{v}, \mathbf{w})$ , where  $\mathbf{v}$  is the vector of input prices,  $\mathbf{w}$  is the wage rate, or vector of household wages, and  $\mathbf{p}$  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

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

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  $W$ :

$$\partial W / \partial p_i = \sum_h \theta_h (y_{ih} - q_{ih}); \quad \theta_h = \partial W / \partial b_h = \left( \partial W / \partial u_h \right) \left( \partial u_h / \partial b_h \right)$$

So that  $\theta_h$  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, 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 changes in 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 (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.

### 3.3 Changes in Rice Prices and Household Income

The study focused on the impact of agricultural trade liberalisation on the changes in prices of rice. 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 year 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.

### 3.4 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).

All rural household groups were divided into five quintiles on the basis of income:

1. Bottom 20 percent (Quintile 1),
2. Lower middle 20 percent (Quintile 2),
3. Middle 20 percent (Quintile 3),
4. Upper middle 20 percent (Quintile 4), and
5. Top 20 percent (Quintile 5).

They were classified into two main groups on the basis of their involvement in farming activities, namely:

- a. Farm households, and
- b. Non-farm households.

Other classification included:

1. Farmers, who owned farm land, and
2. 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):

- a. Small Farmers (0.05-2.49 acres),
- b. Medium farmers (2.50-7.49 acres), and
- c. Large farmers (7.5 acres and above).

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

1. Net buyers or
2. Net sellers.

The study applied the Deaton (1989) methodology, as explained earlier, to identify net seller and net buyer households.

### 3.5 Empirical Frameworks of the Study

#### 3.5.1 Determinants of Household Income

This study investigated the determinants of income to explore the basic sources of welfare of rural households. It examined what characteristics of rural households were associated with the growth in real income. It used econometric models and the ordinary least square (OLS) regression estimation technique to establish relationships between income and various

household characteristics. It considered both economic and non-economic characteristics of rural households to identify determinants of household income.

The economic characteristics include size of land owned by households, and income shares from agriculture, rice, wage-salary, business-commerce, gift-remittance-assistance, house rent, and income from other sources. 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 included 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.

Two separate OLS regression models were carried out – one for 1985-86 (base year) and another for 2005 (current year) – to make 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.

The study 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  $\epsilon_{ht}$  represent the error terms. In the above equation,  $\mu$  and  $\varphi$  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.

### 3.5.2 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 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:

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

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,  $\Delta X_h$  is the matrix of changes in endowments (change in shares of income from different sources), 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. Result Discussion and Analysis

##### Change in Prices of Rice and Household Income

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 1. A decrease in the producer price implies a decline in welfare (income) of rice farmers whereas a decrease in consumer price suggests an increase in the welfare (income) 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.

Table 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, which is analysed in the following sections.

##### Descriptive Statistics of Data

The descriptive statistics of household income is presented in Table 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 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 BBS 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.

### Determinants of Household Income

In regression analysis, only statistically significant variables were considered for analytical purposes and other variables were dropped from the regression models 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.

The study used both economic and non-economic characteristics simultaneously for and considering their joint effects on household income. The OLS regression models revealed that.

Combining economic and non-economic characteristics and considering simultaneously their joint effects on household income, the OLS regression models revealed that household size was the only non-economic factor that was statistically significant and positive determinant of household income in both 1985-86 and 2005. All other non-economic factors were not statistically significant, indicating that they had no influence in determining household income in the post-liberalisation era. This result is presented in Table 3.

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.

This study argues that while the share of rice income was a negative determinant of household income in both 1985-86 ( $-0.009$ ) and 2005 ( $-0.097$ ), the magnitude of its negative influence increased in 2005. Although the share of agriculture income was a positive determinant of household income in both 1985-86 (0.292) and 2005 (0.091), the magnitude of its influence was very insignificant (almost zero) in 2005.

Table 1: Determinants of household income: 1985-86 and 2005 (Dependent variable: Logarithm of household income)

Independent Variables	Regression Coefficients	
	Model 1 (1985-86)	Model 2 (2005)
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

## 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 4, 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.

The study suggests that while agricultural trade liberalisation positively impacted on rice production resulting from technological transformation and leading to a substantial decrease in both producer and consumer prices of rice, farm households experienced a relatively small gain compared to non-farm households due to the decrease in the producer price was greater than that in the consumer price. Farm households constitute the majority (more than 85 percent) (BBS, 2007) 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 food security and self-sufficiency in food-grain production. Therefore, it is crucial to formulate 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 would adversely affect the performance of economic growth, price stability and unemployment – the three major objectives of the government.

This study argues that both shares of agricultural income and rice income were not statistically significant with the initial endowments in determining the growth in household income. Although, the share of agricultural income was not statistically significant in determining the growth in household income in 1985-86, it was a positive determinant in 2005, implying a positive impact of agriculture on growth in income in the post-liberalisation era. Considering the change in the share of agricultural income (change in endowment), it was a positive determinant of income-growth in 1985-86 but was not statistically significant in 2005, suggesting that change in agricultural endowment was not conducive to growth. The study argues that although agricultural was the main source of income (28.7 percent) and employment (60 percent) in the rural economy in 2005 (BBS, 2007), it was not a significant determinant of income and its growth in the post-liberalisation era.

**Table 2:** 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	-.162 (.450)***	excluded, not significant
Share of house rent income	excluded, not significant	-.147 (.987)*
Share of gift, remittance and assistance income	-.190 (.380)***	-.162 (.137)***
Share of other source income	-.333 (.234)***	-.197 (.231)***
<b>Difference Variables</b>		
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	-.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

## 5. Conclusion

The above findings and analyses suggest that household size was the only non-economic factor that was statistically significant and positive determinant of household income in both 1985-86 and 2005. Household size was the largest positive determinant and small farmer dummy was the largest negative determinant of income of rural household in 1985-86. Similarly, household size was the largest positive determinant and farm-household dummy

variable was the largest negative determinant of income in 2005. Although rice is the staple food in Bangladesh, the 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. Considering initial endowments, household land area was the largest positive determinant and share of income from wage-salary was the largest negative determinant of growth in household income in 1985-86. Similarly, considering current endowments, change in the share of income from house rent was the largest positive contributor and the share of income from rice was the largest negative contributor to income-growth in 2005. The share of income from rice was positive determinant considering the current year endowments but was not statistically significant with the base year endowments. While the share of agriculture income was a positive determinant of income in both years, the magnitude of its influence was very insignificant in 2005.

This study argues that while the share of rice income was a negative determinant of household income in both 1985-86 and 2005, the magnitude of its negative influence increased in 2005. Although the share of agriculture income was a positive determinant of income in both 1985-86 and 2005, the magnitude of its influence was very insignificant (almost zero) in 2005. The study suggests that while agricultural trade liberalisation positively impacted on rice production, resulting from technological transformation and leading to a substantial decrease in both producer and consumer prices of rice, farm households experienced a relatively small gain compared to non-farm households due to a greater decrease in the producer price than that in the consumer price.

Farm households constitute the majority of rural communities and contribute much to the rural economy. Based on the findings, this study argues that some farmers may shift from rice to other agricultural or non-farm activities, thus jeopardising the country's food security and self-sufficiency efforts in food-grain production. Therefore, it is crucial to formulate government policies to support farm households by means of income transfer such as tax reduction and production subsidy in order to avoid food security and macroeconomic instability as a result of high food prices due to a shortage of rice production. The government should avoid a high food price shock that could adversely affect the performance of economic growth, price stability and unemployment – the three major objectives of the government.

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