An Econometric Assessment of Household Food Security in Bangladesh

RUSHAD FARIDI
SYED NAIMUL WADOOD[*]

This paper investigates the determinants of household food security situation in Bangladesh. Different household characteristics seem to be strongly correlated with food security indicator which might be helpful in identifying the food insecure households. Regression results show that food security indicator is also highly sensitive to rice price changes. Comparison of different occupational groups was also studied with the findings that wage earners, both daily wage and salary wage earners, are worse off in terms of food security status compared to self-employed-both in agriculture and non-agricultural sector.

I. INTRODUCTION

Food security has been a critical issue in the recent past regime of high food prices across the globe. We note that only a couple of years ago, prices of staples all over the world displayed a dramatic increase. In the case of Bangladesh, since the trade liberalisation in the early 1990s, private sector has played an important role in stabilising prices, particularly that of rice. During the devastating flood of 1998, the stabilising role played by the private imports (Del Ninno, Dorosh and Smith 2003) is a prime example of this. It was mainly possible because import parity price of rice was not exorbitantly high due to availability of enough surpluses in the world rice market at that time. But in more recent times, during 2007-08, situation in the world market was quite different. Rice price was experiencing an upward trend at home and abroad. Existing high import parity price diminished the scope for the private sector to play the same stabilising role during 2007-08.

In this backdrop, it is clear that we need to understand the food security situation in Bangladesh and its determinants while the food price is one of the most dominant factors in determining food security of households. Understanding the determinants is important because it will help the policy makers keep abreast of the main variables that matter for food security in Bangladesh. In this regard, it is

[*] Department of Economics, University of Dhaka, Dhaka, Bangladesh.

important to keep the analysis at the household level. Usually the concern regarding food security is analysed at the national level which masks the actual food security situation at the household level. National level analysis always compares the availability and requirement of food grains. It has to be understood that availability and supply are not always the same. In the same manner requirement and demand might not be corresponding to the exactly same quantity. But the dynamics of food market are fundamentally determined by demand and supply which affects prices and eventually the food security situation of the mass.

Therefore, it is important to have the analysis done in the household level to understand the actual demand for food and thus its affect on the food security situation on households. It helps to understand the different household characteristics that are specific to food security and their implication on the food related issues.

Rest of the paper is organised as follows. Section II has a general overview of the food security situation including definition of food security and different measures of food security. Underlying theoretical and empirical model is described in section III which provides the basis for the results discussed in section V. Section IV discusses data and section VI draws conclusion.

II. OVERVIEW OF FOOD SECURITY

Definition of Food Security

In this section we will have a broad overview of food security related concepts. It is imperative to have these issues clarified at the very beginning which would keep us in strong footing for the rest of the analysis in this study. We begin this section by defining the food security.

Food security is a flexible concept as reflected in the many attempts at definition in research and policy usage. Even a decade ago, there were about 200 definitions in published writings (Maxwell and Smith 1992).

The continuing evolution of food security as an operational concept in public policy has reflected the wider recognition of the complexities of the technical and policy issues involved. The most recent careful redefinition of food security is that negotiated in the process of international consultation leading to the *World Food Summit* (WFS) in November 1996. The contrasting definitions of food security adopted in 1974 and 1996, along with those in official FAO and World Bank documents of the mid-1980s, are set out below with each substantive change in definition underlined. A comparison of these definitions highlights the considerable reconstruction of official thinking on food security that has occurred over 25 years.

Food security as a concept originated only in the mid-1970s, in the discussions of international food problems at a time of global food crisis. The initial focus of attention was primarily on food supply problems - of assuring the availability and to some degree the price stability of basic foodstuffs at the international and national levels. That supply-side, international and institutional set of concerns reflected the changing organisation of the global food economy that had precipitated the crisis. A process of international negotiation followed, leading to the World Food Conference of 1974, and a new set of institutional arrangements covering information, resources for promoting food security and forums for dialogue on policy issues.

The issues of famine, hunger and food crisis were also extensively examined following the events of the mid-1970s. The outcome was a redefinition of food security, which recognised that the behaviour of potentially vulnerable and affected people was a critical aspect.

A third, perhaps crucially important, factor in modifying views of food security was the evidence that the technical successes of the Green Revolution did not automatically and rapidly lead to dramatic reductions in poverty and levels of malnutrition. These problems were recognised as the result of lack of effective demand.

The initial focus, reflecting the global concerns of 1974, was on the volume and stability of food supplies. Food security was defined in the 1974 World Food Summit as: "availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices" (United Nations 1975).

In 1983, FAO expanded its concept to include securing access by vulnerable people to available supplies, implying that attention should be balanced between the demand and supply side of the food security equation: "ensuring that all people at all times have both physical and economic access to the basic food that they need" (FAO 1983).

In 1986, the highly influential World Bank report "Poverty and Hunger" (World Bank 1986) focused on the temporal dynamics of food insecurity. It introduced the widely accepted distinction between chronic food insecurity, associated with problems of continuing or structural poverty and low incomes, and transitory food insecurity, which involved periods of intensified pressure caused by natural disasters, economic collapse or conflict. This concept of food security is further elaborated in terms of: "access of all people at all times to enough food for an active, healthy life."

By the mid-1990s food security was recognised as a significant concern, spanning a spectrum from the individual to the global level. However, access now involved sufficient food, indicating continuing concern with protein-energy malnutrition. But the definition was broadened to incorporate food safety and also nutritional balance, reflecting concerns about food composition and minor nutrient requirements for an active and healthy life. Food preferences, socially or culturally determined, now became a consideration. The potentially high degree of context specificity implies that the concept had both lost its simplicity and was not itself a goal, but an intermediating set of actions that contribute to an active and healthy life.

The *1994 UNDP Human Development Report* promoted the construct of human security, including a number of component aspects, of which food security was only one (UNDP 1994). This concept is closely related to the human rights perspective on development that has, in turn, influenced discussions about food security. (The WIDER investigation into the role of public action into combating hunger and deprivation found no separate place for food security as an organising framework for action. Instead, it focused on a wider construct of social security which has many distinct components including, of course, health and nutrition).

The 1996 World Food Summit adopted a still more complex definition:

"Food security, at the individual, household, national, regional and global levels [is achieved] when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO 1996).

This definition is again refined in The State of Food Insecurity 2001:

"Food security [is] a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO 2002).

This new emphasis on consumption, the demand side and the issues of access by vulnerable people to food, is most closely identified with the seminal study by Amartya Sen (1981). Eschewing the use of the concept of food security, Sen focuses on the entitlements of individuals and households.

The international community has accepted these increasingly broad statements of common goals and implied responsibilities. But its practical response has been to focus on narrower, simpler objectives around which to organise international and national public action. The declared primary objective in international development policy discourse is increasingly the reduction and elimination of poverty. The 1996 WFS exemplified this direction of policy by making the primary objective of

international action on food security halving of the number of hungry or undernourished people by 2015.

Essentially, food security can be described as a phenomenon relating to individuals. It is the nutritional status of the individual household member that is the ultimate focus, and the risk of that adequate status not being achieved or becoming undermined. The latter risk describes the vulnerability of individuals in this context. As the definitions reviewed above imply, vulnerability may occur both as a chronic and transitory phenomenon. Useful working definitions are described below.

Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life. Household food security is the application of this concept to the family level, with individuals within households as the focus of concern.

Food insecurity exists when people do not have adequate physical, social or economic access to food as defined above.

Measures of Household Food Security

Measurement of household food security is typically indirect and based on food balance sheets and national income distribution and consumer expenditure data. Linking hunger with inadequate food intake allows the measurement of food insecurity in terms of the availability and apparent consumption of staple foods or energy intake. This type of measurement corresponds to the earlier narrower definitions of chronic food insecurity.

The above measure is calculated as the percentage of households in a population group who do not consume sufficient dietary energy. It is measured by determining whether a household acquires sufficient food over the reference period to meet the dietary energy requirements of all of its members. If the estimated total energy in the food that the household acquires daily is lower than the sum of its members' daily requirements, the household is classified as food energy deficient. The requirements employed are those for basal metabolic function (a state of complete rest) and light activity, such as sitting and standing. There is some debate about what is the correct energy requirement. Energy requirement depends on age, sex, body weight, activity and lots of other factors. In practice, WHO (1985) recommendation is followed which is based normatively specified minimum energy consumption levels given a minimum acceptable body weight for healthy people at each age and sex group. When the percentage of people, as opposed to households, is measured, each person is assigned the energy deficiency status of her or his household.

Even if a household fulfills the food energy requirement, it does not guarantee whether it could manage the required nutrient to maintain a healthy life. In that sense, dietary diversity is considered to be a good measure of dietary quality. It is usually considered that a household should have more than ten different food items over the course of a week to maintain healthy diet diversity.

The above two does not capture one important component of food security, that is, vulnerability to food deprivation in the future. One indicator of the vulnerability might be percentage of household expenditure on food. If that percentage is high, which is typically true for poorer households, the household is likely to suffer some food deprivation whenever it is facing some degree of income shock.

In our analysis, we will focus on the calorie requirement dimension of these measures as this is a direct measure of food security and is regarded as the most representative one among all the measures of household food security.

III. MODELING HOUSEHOLD FOOD SECURITY

Theoretical Framework

The household food security can be modeled in the framework of consumer demand and production analysis following the Agricultural Household Models (AHMs) (Singh, Squire and Strauss 1986). In AHM models an agricultural household is both a consumer and a producer. Given the assumption of "separability" of consumption variables and production variables, the AHM model household can separate production decisions from the consumption preferences– first it solves the production decisions (independent of consumption preferences) and then it solves the consumption decisions (based on optimal production decisions).

The household utility function is specified as

$$U = U(F_i, F_m, l; D_h) \tag{1}$$

where U is a utility function that is assumed to be well behaved (twice differentiable, increasing in its arguments and strictly quasi-concave); F_i is a vector of home-produced goods consumed by the household; F_m is a vector of market-purchased goods consumed by the household; and l is leisure. Here D_h is the demographic characteristics of the household.

The household, as both producer and consumer, is assumed to maximise its utility from the consumption of the goods subject to farm production, income and time constraint such as

$$G(Q_i, L, A^0, K^0) = 0 \tag{2}$$

$$P_i (Q_i - F_i) - P_m F_m - w(L - L_f) + N = 0 \tag{3}$$

$$T = L_f + l \tag{4}$$

where G(.) is an implicit production function that is assumed to be well-behaved (twice differentiable, increasing in outputs, decreasing in inputs and strictly convex); Q_i is a vector of quantities of goods produced on-farm; L is total labour input to the farm; A^0 is the household's fixed quantity of land; K^0 is the fixed stock of capital; P_i is the price of good i; P_m is the price of market-purchased good; $(Q_i - F_i)$ is the marketed surplus of good i; w is the wage rate; L_f is the household labor supply for on-farm use; N is non-farm income that adjusts to ensure that equation (3) is zero; T is the total time available to the household to allocate between work and leisure.

Given the assumption of "separability," the production side can be solved first. The first-order conditions for input demand (L*) and output supply (Q*) in terms of all prices, wage rate, fixed land and capital as,

$$L^* = L^*(P_i, w, A^0, K^0) \tag{5}$$

and

$$Q^* = Q^*(P_i, w, A^0, K^0) \tag{6}$$

Rearranging equations (3) and (4) and putting L* and Q* into the rearranged equation,

$$Y^* = P_i Q_i^* + wT - wL^* + N \tag{7}$$

and

$$Y^* = wT + \pi^*(P_i, w, A^0, K^0) + N \tag{8}$$

where Y* is "full" income under the assumption of maximized profit π^*.

Now, the first-order conditions for consumption demand can be solved for in terms of prices, wage rate and income as--

$$F_k = F_k (P_i, P_m, w, Y^*) \tag{9}$$

-- (here k=i,m). Incorporating the household characteristics (D_i), the demand for food can be rewritten as,

$$F_k = F_k[P_i, P_m, w, Y^* (w, A^0, K^0, N), D_h] \tag{10}$$

Econometric Framework

After determining the demand for both home-produced and market-purchased goods, we can use "Food-Calorie Conversion Table" to calculate the amount of calories (C_i) available in the respective food items. Now, one can define "household food security" as $C_i^* = C_i - \gamma_i$ (C_i is the calorie availability and γ_i is the specific

calorie requirement for that particular ith household), and $C_i^* \geq 0$ indicates that the household is "food secure" while $C_i^* < 0$ indicates that the household is "food insecure." Assuming a linear function, one can write the food security equation as,

$$C_i^* = \sum_{j=1}^{n=k} \beta_j X_{ij} + \varepsilon_i \tag{11}$$

The household observed to be food secure ($Z_i = 1$) is assumed to have $C_i^* \geq 0$; while the household observed to be food insecure ($Z_i = 0$) is assumed to have $C_i^* < 0$. Here the dependent variable Z_i is a discrete variable, the model is a qualitative response model where φ_i is the probability of food security, such as,

$$\varphi_i = \text{Prob} \ (Z_i = 1) = \text{Prob} \ (\sum \beta_j X_{ij} + \varepsilon_i > 0) \tag{12}$$

One can consider a logistic regression model of food security as

$$\text{Ln} \ (\varphi_i \ / \ [1 - \varphi_i]) = \beta_0 + \sum_{j=1}^{n=k} \beta_j X_{ij} + \varepsilon_i \tag{13}$$

where φ_i is the conditional probability of food security and β_j's are parameters to be estimated. X_{ij}'s are the independent variables. Given this standard framework of AHM (Feleke, Kilmer and Gladwin 2005) in the case of "household food security model" we move on to the analysis of determinants of household food security.

IV. DISCUSSION OF DATA

Source of the data used in the following analysis is *Household Income-Expenditure Survey (HIES)* for 2005. This survey (BBS 2007) provides valuable data on household income, expenditure, consumption, savings, housing condition, education, employment, health and sanitation, water supply and electricity etc.

Food energy consumption is measured at the household level as the total amount of energy in the food acquired by the household over the survey reference period for food data collection (the total time for which data are recorded). Calculation of this measure starts with the food data collected from the HIES 2000 and 2005 where for each household quantities acquired for different types of foods are listed.

The energy contents of the edible portion of all foods acquired are then summed and divided by the number of days in the reference period and the number of household members to arrive at the total energy acquired per household member. Note that although the data collected from households represent foods acquired, the mean of this measure across a randomly selected sample of households is felt to be a reasonably good estimate of mean food energy consumed by a population.

Actual energy requirements of individuals depend on their age, sex, body size, activity level, and individual physiology, for example, metabolism. When determining the energy needs of a group of individuals, given unknown actual requirements (because of individual variation), the Expert Consultation on Energy

and Protein Requirements recommends the use of average energy requirements for people of different sex and age groups, levels of activity, and, for adults, body size, which apply to all individuals globally.

In HIESs, data are collected on age and sex but none of the other characteristics. Use of the "light" activity level is recommended here as a normative standard applicable to all populations. A person who does not consume enough food to meet the energy requirement for basal metabolic function and light activity of the average-weight person in his or her age and sex group is considered food energy deficient. However, because we do not know each person's actual requirement (for basal metabolic function and light activity), and because in each age and sex group there is actually a range of requirements that may apply to individuals, there will be some classification error. Some people whose actual requirement is below the average might have an energy consumption level below the average requirement but still be meeting their own individual requirement. Similarly, some people whose actual requirement is above the average might have an energy consumption level above the requirement but below their own individual requirement. For estimating population prevalence, if these two groups are roughly the same size, the errors cancel each other out. Whether they are the same size is also a subject for future research.

After gathering data on calorie availability and requirement, food secure household is defined as the household which can meet requirement and food insecure households are those which have availability below the requirement.

V. RESULTS

Food Security and Household Characteristics

There are evidences that, other than consumption levels, different household characteristics can also show improvement in the standard of living. Since food security and standard of living are expected to be highly correlated, it would not be surprising to find these characteristics to be related with food security issues. Hence, it would be reasonable to expect that households with better characteristics are also demonstrating lesser level of food insecurity. Table I describes the relationship between these different household characteristics and food security and the dynamic change in this relationship for the year of 2005.

Quality of housing and food security level are closely related in Bangladesh, established by earlier works (Narayan,Yoshida and Zaman 2007). Specifically households which are living in houses built with straw roofs (hemp/hay/bamboo) are the poorest segment of the population. Similarly, as shown in Table I, in households living in houses with straw roofs, food insecurity is the most prevalent

(the category "other" which might be squatter, free shelter, etc). On the other extreme, houses with brick wall seem to be the most food secure. These two observations show that household infrastructure is a strong indicator of wealth and consequentially, the food security situation.

If we categorise households by the level of ownership, occupancy status also plays an important part in determining the household welfare situation. Owners of the houses are better-off in terms of food security compared to other categories. In the same manner, electricity connection is also an indicator showing higher instances of food-insecurity among the households which have no electricity connection.

TABLE I
AMENITIES, INFRASTRUCTURE AND FOOD INSECURITY

	% Food Insecure
Construction Material (wall)	
Brick/cement	36.4
CI sheet/wood	37.8
Mud brick	42.1
Hemp/hay/bamboo	45.8
Other	42.0
Present Occupancy Status	
Owner	40.2
Renter	44.9
Squatter	44.0
Other	46.3
Any Electricity Connection?	
NO	42.9
YES	37.9

Source: *HIES 2005* (Author's Calculation).

Education is clearly linked with food security issues with the assumption that household heads with more human capital are prone to suffer less from food insecurity. This presumption is aptly reflected in Table II where there is a general trend of decrease in food insecurity as the education level of household is increasing.

Being an agricultural country, possession of land shows the general level of wealth for households. Typically, landless population falls into the category of extreme poor and we find the same phenomenon in Table III which implies a negative correlation between amount of land owned and food insecurity index.

It would be of interest to know which income group is the most affected by the increase in food prices and thus suffer from food insecurity. Usually, the argument is that regular wage earners are the most affected since their income is fixed and thus with higher food prices, their real income goes down. On the other hand, self-employed are able to vary their work or effort level and thus can compensate at least partly for this high level of food prices. Table IV provides credence to this observation where all the wage earning categories are suffering from lower degree of food security. Households where the household head is daily wage earner in both agricultural and non-agricultural sector are the worse in terms of food security. Salary wage earners are just slightly better than the daily wage earners. On the other hand, self-employed, both in agricultural and non-agricultural sector are faring well compared to any other categories. Therefore, empirical evidence is quite consistent with the general theory that fixed wage earners suffer more from food insecurity.

TABLE II
HOUSEHOLD HEAD'S LEVEL OF EDUCATION AND FOOD SECURITY

Highest Grade by Household Head	% Food Insecure
Primary or less (1-5 years)	42.0
Secondary or less (6-10 years)	37.1
Higher secondary or less (11-12 years	38.8
Graduate or less (13-16) years)	44.4

Source: HIES 2005 (Author's Calculation).

TABLE III
LAND SIZE AND FOOD INSECURITY

Land Size	% Food Insecure
Landless<0.05 acre	48.4
Functionally landless 0.05-0.5 acre	43.7
Marginal 0.5-1.5 acres	34.3
Small 1.5-2.4	32.4
Medium/Large: 2.5 acres or more	26.9

Source: HIES 2005 (Author's Calculation).

TABLE IV
EMPLOYMENT TYPE AND FOOD SECURITY

Employment Type	% Food Insecure
Daily wage (agri)	48.2
Self-employed (agri)	29.8
Daily wage (non-agri)	46.9
Self-employed (non-agri)	39.3
Wage employment (non-agri)	45.2

Source: HIES 2005 (Author's Calculation).

Identifying the Determinants of Food Security

Logistic regression results in Table V are used to estimate the determinants of food security at the household level. Logistic regression is used to find the log-odds ratio of food security with the dependent variable acting as the dummy for the food security indicator. In the regression, sex of household head has not been found to be a statistically significant factor even at 10% level of significance, though the sign of the coefficient is negative. Statistical insignificance can be attributed to a very low number of households with female heads (less than 10 per cent in the sample). The negative sign of coefficient is not surprising since female headed households are found to be more vulnerable with lesser household assets in general. Most of the female heads are widowed or abandoned by the husband in rural Bangladesh who have vulnerability in all aspects of livelihood characteristics.

Age of the household head does not seem to have practically and statistically strong significant impact on food security, whereas education of household head is highly statistically significant though the impact seems to be quite marginal. This might not be surprising in the sense that with high unemployment rate and widespread underemployment, the returns to education in the market are not that high. As a result, education does not help much to alleviate the food security situation.

The infrastructure quality of households might be an important indicator of living standards of households as we have already discussed above (Table I). The regression model includes dummy variables indicating the materials of household wall with the base category indicating the household wall is made of hey/straw, the category which represents the poorest segment of the household. Table IV shows that, after taking care of all other factors that might affect the household food security, houses made with brick wall are 3 per cent more likely to be food secure than houses made of hey/straw while the effect is statistically significant. In the same manner, houses made with mud are 4.7 per cent more likely to be food secure than houses made of hey/straw. Here, we have to emphasise the difference between descriptive analysis we presented earlier in tables and regression analysis in this section. The advantage of regression analysis is that it captures the ceteris paribus effect which the tabular description fails to capture.

Among the other factors, not surprisingly, total land owned by the household put a strong impact on food security situation with a high statistical significance. Table IV indicates that one decimal increase in land leads to around 5.1 more likelihood for a household to be food secure. Availability of electricity connection is another strong indicator of household welfare in terms of food security.

Households with electric connection are around 4 per cent more likely to be food secure than those which do not have any electricity connection.

TABLE V
DETERMINANTS OF FOOD SECURITY

	Logit	Mar. Effect
Sex of Household head	-0.210(0.145)	-0.052(0.145)
Age in years	0.024+(0.094)	0.006+(0.094)
Age squared	-0.000(0.598)	-0.000(0.598)
Education of household head	0.026**(0.001)	0.006**(0.001)
House with brick wall (d)	0.120(0.228)	0.030(0.229)
House with wooden wall (d)	0.059(0.397)	0.015(0.397)
House with mud wall (d)	0.188*(0.021)	0.047*(0.021)
Total Land (decimal)	0.187**(0.000)	0.047**(0.000)
Household with electricity (d)	0.176**(0.007)	0.044**(0.007)
log of Price of Rice	-1.366**(0.000)	-0.339**(0.000)
Males (1-15 years old)	-0.287**(0.000)	-0.071**(0.000)
Males (16-49 years old)	-0.390**(0.000)	-0.097**(0.000)
Males (Above 50 years)	-0.506**(0.000)	-0.126**(0.000)
Females (1-15 years old)	-0.277**(0.000)	-0.069**(0.000)
Females (16-49 years old)	-0.098+(0.055)	-0.024+(0.055)
Females (Above 50 years)	0.090(0.196)	0.022(0.196)
Self-employed: agri (d)	0.414**(0.000)	0.103**(0.000)
Daily wage: non-agri (d)	-0.167+(0.061)	-0.041+(0.059)
Self-employed: non-agri (d)	0.034(0.704)	0.009(0.705)
Salary wage employment (d)	-0.408**(0.000)	-0.099**(0.000)
Recieved Safety Net? (d)	-0.216*(0.012)	-0.053*(0.011)
Observations	5935	5935
Pseudo *R2*	0.068	0.068

Note: Marginal effects; *p-values* in parentheses.
(d) for discrete change of dummy variable from 0 to 1.
+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$.
Source: HIES 2005 (Authors' Calculation).

For the purpose of this study, the most important variable in this regression analysis would be the variable representing the price of coarse rice. Our results show that one per cent increase in the price of coarse rice leads to around thirty four per cent reduction in the likelihood of being food secure. This measure underscores

the importance of rice price in determining the food security of a typical household in Bangladesh. This coefficient also provides a quantifiable measure of the impact of rice price on the overall food security situation of the households.

The rest of the variables control for age-sex ratio in the family to reflect the demographic structure of households which might have important implication for food security. In general, all the coefficients are negative, implying that the greater the number of household members in the household, the lower the food security situation. Even then, investigating individual categories might give important insights. Among the males, it shows that increased presence of male more than 50 years old has the largest negative impact on the food security situation. This is expected given the fact that male is the principal income earner for a household and as the age increases it greatly reduces the income potential for the households and thus implies negative impact on the household food security situation. Similarly, the presence of female member, in the same age range, does not have any statistically significant impact on the household food security situation.

 Household head's occupation also might have strong bearings on the food security situation which is captured by the relevant dummy variables. The base category is household head's occupation in agricultural labor, which is supposed to be the most distressed economically. But in the regression framework, after controlling for other household characteristics, we find that the households, with their head engaged in salaried wage employment, are around 10 per cent more likely to be food insecure than households with their head in agricultural labour.

The last variable indicating whether the household received safety net programs or not requires some elaboration. This variable distinguishes households who received safety nets from those which did not and this distinction is important because these two types of households might have some fundamental differences in their livelihood patterns. It is important to control for this aspect in the regression framework to capture unbiased effects of other variables. The marginal effect of this variable shows that households which were recipient of safety net programmes are five per cent more likely to be food secure, which indicates the effectiveness of these programmes.

VI. CONCLUDING REMARKS

In this study we were able to identify some major factors that might affect the household food security situation. For policy-making, it is very important to understand the dynamics of these factors since alleviation of food insecurity among the vulnerable is crucial in the current scenario of high food grain prices. Having an idea about the factors affecting food security might help in making an informed

decision by the policymakers. Further study is needed to investigate the high responsiveness of food security to rice prices. Since major calorie requirement comes from rice consumption, it is expected that rice prices have a pronounced impact on food security. But the magnitude is quite staggering in this study which might have far-fetched implication for policy making. In the same manner, we need to consider whether safety net receipt might be endogenous in the sense that the same factors that affect the safety net might also affect the food security situation. This study has not been able to address all these questions but has been able to put forward a framework under which future research on food security can be done.

REFERENCES

BBS. 2007. *Report of the Household Income & Expenditure Survey*. Dhaka, BBS.

Del Ninno, C., P. Dorosh and L .C. Smith. 2003. "Public Policy, Markets and Household Coping Strategies in Bangladesh: Avoiding a Food Security Crisis Following the 1998 Floods." *World Development* **31**(7): 1221-38.

FAO.1983. *World Food Security: a Reappraisal of the Concepts and Approaches. Director General's Report*. Rome.

_____1996 *Rome Declaration on World Food Security and World Food Summit Plan of Action*. Rome; World Food Summit.

_____2002. *The State of Food Insecurity in the World 2001*. Rome.

Feleke, S. T., R. L. Kilmer, and C.H. Gladwin. 2005. "Determinants of Household Food Security in Southern Ethiopia at the Household Level." *Agricultural Economics,* 33: 351-363.

Maxwell, S. and M. Smith.1992. "Household Food Security: a Conceptual Review." In Household Food Security: Concepts, Indicators, Measurements: A Technical Review. S. Maxwell and T. R. Frankenberger. New York and Rome: UNICEF and IFAD.

Narayan, A., N. Yoshida and H. Zaman. 2007."Trends and Patterns of Poverty in Bangladesh in Recent Years."

Sen, A. 1981. *Poverty and Famines*. Oxford: Clarendon Press.

Singh, I., L. Squire and John Strauss. 1986. *Agricultural Household Models: Extensions, Applications, and Policy*. Baltimore: Johns Hopkins University Press.

UNDP.1994. *Human Development Report 1994*. Oxford and New York: UNDP.

United Nations. 1975. *Report of the World Food Conference*. Rome.

World Bank.1986. *Poverty and Hunger: Issues and Options for Food Security in Developing Countries*. Washington DC.