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DO POOR PEOPLE BENEFIT FROM MICROCREDIT PROGRAM? EVIDENCE FROM BANGLADESH

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The microcredit program in Bangladesh is a unique innovation of credit delivery designed to enhance the income generating activities of the poor. Not only the founder of the Grameen Bank is awarded the 2006 Nobel Peace Prize on microcredit program, but is has also been a topic of great interest to researchers since its introduction in mid-1970s. This study investigates the consumption pattern of different income level microcredit borrowers. Using primary data collected from borrowers of the Grameen Bank and Bangladesh Rural Advancement Committee (BRAC) the study estimates budget share of consumables. The study uses quasi-experimental approach by comparing consumption patter of the borrowers with the non-borrowers from non-program villages. In investigating the impact of per capita monthly expenditure and other household characteristics on the budget share of the items consumed by borrowers and non-borrowers, the study relies on the *an Almost Ideal Demand System* (AIDS) framework. Using Ordinary Least Squares (OLS) estimation, on monthly budget share of twelve household consumables (food and non-food items) our result shows high income borrowers of microcredit programs are better off in terms of consumption than low and middle income borrowers.

JEL Classification: C81, D19

Keywords: Microcredit, consumption pattern, budget share, AIDS model

I. INTRODUCTION

The insufficiency of in testable fund has been considered as a major constraint to the expansion of output in many low-income countries. Such a constraint is more prominent for the poor who do not have access to the formal sector due to lack of collateral. The governmental and non-governmental agencies in these countries have therefore, introduced credit program to promote self employment especially among the poorer section of the society. Microcredit program in Bangladesh is one of the most remarkable and successful one to be mentioned here. Its collateral free group based lending program is unique in credit delivery technique which generates activities and income growth in variety of informal ways (Hulme and Mosley 1996; Yunus 1999; World Bank, 1994).

Because of its distinctive nature of credit delivery, high recovery rate, and focus on women, microcredit in Bangladesh has drawn attention of researchers throughout the world. The Grameen Bank of Bangladesh is the largest microcredit institution and the Bangladesh Rural Advancement Committee (BRAC) is the largest non-governmental organisation (NGO). These institutions are the pioneers of microcredit in Bangladesh and are providing services for almost three decades. Based on the observations from recent research (Hossain 1988; Yaron 1992; Montgomery *et al*. 1996; Khandker 2003), it is argued that microcredit is improving the standard of living and well being of the borrowers by improving their level of consumption, asset accumulation and social empowerment.

It is also expected that there may be a significant difference in the expenditure patterns of the borrowers. Due to availability of funds, it is expected that the borrowers are having better consumptions as well. This study aims to investigate the consumption behaviour of different income level microcredit borrowers.

This is an updated version of an earlier study[1]. AIDS model specified in Rahman, (2006), used dependency ratio (calculated as the total number of non-earners over total number of earners) and the age of borrowers. Since the co-efficient of these variables were not found significant, we have modified the model in this study after deleting these variables. Along with that the earlier study used linear as well as quadratic model whereas we have divided borrowers into three groups and compared if there is any difference in consumption behaviour between different income level borrowers.

In this study we restrict our attention only on the consumption behaviour of different income level microcredit borrowers. It further examines and compares the consumption between microcredit borrowers and non-borrowers from non-program villages to see if there is any significant difference in the consumption pattern of the two groups.

The rest of the paper is structured as follows. Section Two provides the background literature. Section Three describes data and its sources. Section Four specifies the model and results are discussed in Section Five. A conclusion is drawn in the final section.

II. BACKGROUND LITERATURE

Study on consumption pioneered by Stone (1953) is performed by estimation of systems of demand equations explicitly derived from the consumer's theory. The availability of household survey data from developed countries explains the huge empirical literature that has attempted to estimate systems of demand equations for different consumption categories. The estimation of the consumption-income relationship or Engel relationship from cross-section data has been paid considerable attention in the literatures on developed countries. Blundell and Ray (1984) studied the Engel curve analysis on demand system, while Giles and Hampton (1985) studied the same on household expenditure using New Zealand data. Beneito (2003) estimated income elasticity using Engel curve analysis on Spanish economy.

Sawtelle (1993) estimated two linear Engel functions for household total expenditure and 15 aggregate classification of consumer durable, non-durable and service expenditures using US cross section data. Using data from the United States, Lee and Brown (1986) examine food expenditure on household data.

Apart from Engel model, Deaton and Muellbauer (1978) introduced AIDS model (An Almost Ideal Demand System), which has been subsequently adopted by Ray (1980). However, studies on consumption in the context of developing countries are not overwhelming. In this regard it is worth mentioning the study conducted by Weiskoff (1971), who studies demand elasticity for the developing economy. Ray and Meenakshi (2002), combine the expenditure and demographic information contained in the unit records of nearly 70,000 households to analyse rural poverty in India. Dey (2000) analyse the demand for fish in Bangladesh. Hendriks and Lyne (2003) use panel data on two villages of Africa. Ferdous (1997; 1999) uses AIDS model on household consumption using secondary data from the Bangladesh Bureau of Statistics.

From the literature so far reviewed no study has yet been found that used AIDS model to analyse the impact of microcredit program in Bangladesh on consumption behaviour. The study uses primary data from borrowers of two major micro-credit institutions and non-borrowers data from non-program villages. The underlying research question for this study is as follows: "Are the high-income microcredit borrowers better off in terms of consumption behaviour than the low and middle income borrowers"? In order to examine this, the study estimates budget share of twelve consumable food and non-food items commonly consumed by the households. Also, total expenditure is used as a proxy for income in the analysis as it is simply the sum of the expenditure items.

III. SOURCE OF DATA

In this study we have used primary data from borrowers of two major microcredit institutions in Bangladesh such as the Grameen Bank and BRAC collected through a structured questionnaire[2]. These two large institutions have coverage all over the country. Based on different agro-climatic and socio-economic conditions we have selected three districts of Bangladesh to collect data. The districts are Gazipur, Dinajpur and Chokoria. Gazipur is close to Dhaka, the capital city and Dinajpur and Chokoria are chosen from far north and south part of the country to have different socio-economic effect. From each districts five villages are chosen at random. The borrowers are selected in a cluster from each village. To avoid endogeneity non-borrowers data has been collected from non-program villages. Non-borrowers are selected from non-program villages to sharing the same socio-economic and cultural background to provide a control group for comparison with borrowers. The samples of borrowers are randomly selected without replacement from the list of households available from the programs' local office of each village.

From all three districts 387 borrowers and 184 non-borrowers were interviewed through a structured questionnaire. Items consumed by households in a month are classified broadly as food and non-food. Total items consumed by the households are classified in ten broad categories of commodities. The food items are; (1) Cereals (consists of rice and food grains); (2) Lentils (consists of pulses of all types); (3) Vegetables (including fruits); (4) Meat and Fishes (consists of chicken, beef, mutton and fishes of all type), and (5) Milk and Eggs. The non-food items are; (1) Fuel (consists of wood, kerosene and similar product used for cooking); (2) Electricity; (3) Clothing; (4) Education; and (5) Health.

IV. METHODOLOGY

There are two important methodological issues that need to be addressed while perusing research on impact of microcredit program on socio-economic aspects of the poor. The issues are "heterogeneity bias" and "selection bias". Heterogeneity bias arrises due to impossibility of finding two villages or households that are identical in all attributes (age, education, family background and so on). There are few ways that this bias could be minimised. Khandker (2003) used panel data and identified appropriate instruments to use as control group to correct for biases. Due to impossibility of finding two identical villages comparison techniques used by some researchers to assess impact of micro-credit are not without limitations. In the absence of panel data and appropriate instruments we have used quasi-experimental approach in the study to avoid heterogeneity bias. We have used control-group method by comparing microcredit borrowers with non-borrowers from non-program villages.

As we know decision to participate in a microcredit program is self-selective. This type of self-selection problem may be corrected through Heckman's two stage correction procedure. Since no suitable instruments have been identified which would permit the use of techniques such as the Heckman procedure to correct this self-selection bias, we did not look at the causal impact of program participation in this study.

1. Model Specification

The AIDS model used by Ray (1980) is originated from Engel curve analysis. It is the time series counterpart of Engel function suggested by Leser (1976). It is formulated as follows:

$$B_i = \alpha_i + \beta_i \log X + C \tag{1}$$

Where, B_i and X are the budget shares of the *i*-th item and total household expenditure respectively and α_i and β_i are the parameters. The model allows negative co-efficient for necessary item and positive for luxury and inferior goods.

AIDS as obtained from the PIGLOG cost function corresponding to the PIGL (Price Independent Generalised Linearity) after the choice of appropriate functional form is given by:

$$\begin{aligned} &B_i = \alpha_i + \beta_i \log\left(\frac{X}{P}\right) + \sum \gamma_{ij} \log P_j + C \\ &i, j = 1, 2, ...n \end{aligned} \tag{2}$$

Where, α_i, β_i and γ_{ij} are the parameters and P is an over all price index defined in terms of individual prices by:

$$\log P = \alpha_0 + \sum \alpha_i \log P_i + \frac{1}{2} \sum_i \sum_j \gamma_{ij} \log P_i \log P_j \tag{3}$$

These functions should meet the well-known adding-up restriction, homogeneity, symmetry, and negativity conditions. In the absence of price the condition to be met is only the adding up restriction, since all the other restrictions are derived from the consideration of prices (Beneito, 2003). The price formulation in Equation (3) makes Equation (2) a non-linear system of equations. To avoid non-linear estimation, Deaton and Muelbauer (1978) use the Stone (1953) index as a convenient approximation:

$$\log P \cong \log P^* = \alpha_0 + \sum_i \beta_i \log P_i \tag{4}$$

Using the utility basis of the PIGLOG model, as the cost at the reference year (*p = 1*) for an individual to subsist, the linear system takes the following form:

$$B_i = \alpha_0 + \beta_i (\log X - \alpha_0 - \sum_i \beta_i \log P_i) + \sum_j \gamma_{ij} . \log P_j + e \tag{5}$$

After incorporating family size (Ray 1980), the model takes the following form:

$$B_i = \alpha_0 + \beta_i \log(x / P^*) + \sum_j \gamma_{ij} . \log P_j + \phi_i \log f + e \tag{6}$$

Where, *f*, $x = (X/f)$, γ_{ij} and ϕ denote family size, per capita household expenditure, the effect

of prices and the effect of family size respectively. Since there is no price data available, the present study assumes that all the households observe the same price. This assumption follows Ferdous (1997). So equation (6) becomes:

$$\begin{aligned} & B_i = \alpha_i + \beta_i \log x + \phi_i \log f + c \\ & or \quad B_i = \alpha_i^{'} + \beta_i \log x + \phi_i \log f \\ & where, \ \alpha_i^{'} = \alpha_i + c \\ & c = \sum_i \gamma_{ij} \log P_j - \beta_i \log P^* \end{aligned} \tag{7}$$

In order to investigate if there is any significant difference in consumption of borrowers and non-borrowers of microcredit, a dummy variable called BD (borrower dummy), is added in the model. Where, $BD = 1$ for the borrowers and zero otherwise. However, district dummies are also added in the model to see if there is any significant difference in consumption between districts (though it is assumed that the districts are not identical in all respect). As sample has been collected from three districts in Bangladesh, the model introduces two district dummies. Where $DD_1 = 1$, for Gazipur and zero otherwise; $DD_2 = 1$ for Dinajpur and zero otherwise. After adding the dummy variables the model becomes:

$$\begin{aligned} & B_i = \alpha_i + \beta_i \log x + \delta_i \log f + \gamma_i BD + \pi_i DD_1 + \chi_i DD_2 + \varepsilon_i \\ & \forall_i = 1, 2.....12 \end{aligned} \tag{8}$$

The study estimates the AIDS model (Equation 4.8) using ordinary least square estimation.

V. ESTIMATION RESULTS AND DISCUSSION

This section provides empirical results with the interpretation of the estimates. A brief discussion of the summary statistics is provided here to give an idea of average consumption of the items in each district.

1. Percentage and Mean Consumption of the Items by Districts

Table 1 shows the average consumption of food and non-food items for both borrowers and non-borrowers in all three districts. The percentage consumption of each item is shown in parentheses. Percentage consumption of each item is calculated by dividing the mean consumption by the total expenditure multiplied by hundred.

According to Table 1, the percentage consumption of staple food such as cereals, pulses and vegetables, of non-borrowers of all three districts are higher than borrowers. On the other hand, percentage consumption of protein items such as meat and fish and milk and eggs are higher for borrowers in all districts. Percentage consumption of the total non-food items is higher for borrowers and percentage consumption of the total food items is higher for non-borrowers in Gazipur and Dinajpur district but not in Chokoria district. Cigarette consumption of non-borrowers is also higher in all three districts. Two conclusions may be derived from the above discussion. Firstly, borrowers spend more of their budget on protein than on cereals and secondly, non-borrowers spend more on food than on non-food items.

While looking at the non-food data, Table 1 shows fuel consumption is higher for borrowers in Gazipur and Dinajpur districts; electricity consumption is higher for non-borrowers in all districts. Again the clothing consumption is higher for borrowers of Gazipur and Dinajpur but not in Chokoria district.

Expenditure on education is higher for borrowers in all three districts but expenditure on health does not reveal a pattern. Finally by looking at the total non-food items, it may be concluded that the spending on non-food items is higher for borrowers in Gazipur and Dinajpur districts and cumulatively in all districts for borrowers.

Table 1
Average Consumption of Borrowers and Non-borrowers of three Districts

	Gazipur		*Dinajpur*		*Chokoria*		*Total*	
	Borrower	*Non-borrower*	*Borrower*	*Non-borrower*	*Borrower*	*Non-borrower*	*Bor.*	*NB*
Cereal	835.80	743.02	874.78	919.65	725.59	716.12	812.05	792.93
	(13.68)	(16.07)	(19.91)	(22.99)	(15.11)	(16.93)	(16.23)	(18.66)
Pulses	196.74	195.55	191.78	199.53	197.99	190.16	95.50	195.08
	(3.22)	(4.23)	(4.37)	(4.98)	(4.12)	(4.49)	(3.90)	(4.57)
Vegetable	559.13	509.77	520.84	503.01	450.00	390.29	510	467.69
	(9.15)	(11.02)	(11.85)	(12.57)	(9.37)	(9.23)	(10.12)	(10.94)
Meat & Fish	1317.34	732.35	1003.43	848.65	1166.85	837.04	1162.54	806.01
	(21.56)	(15.84)	(22.84)	(21.21)	(24.30)	(19.80)	(22.9)	(18.95)
Milk & Egg.	293.81	198.72	174.54	152.47	214.7	209.29	227.68	186.82
	(4.81)	(4.29)	(3.97)	(3.81)	(4.47)	(4.95)	(4.42)	(4.35)
Cigarettes and betel leafs	245.40	239.15	130.91	138.25	197.42	173.58	191.24	183.66
	(4.02)	(5.17)	(2.98)	(3.45)	(4.11)	(4.10)	(3.70)	(4.24)
Other	550.33	479.64	384.23	369.53	383.1	330.09	439.22	393.08
	(9.01)	(10.37)	(8.79)	(9.24)	(7.98)	(5.52)	(8.59)	(8.37)
Total food	3998.56	3098.21	3280.53	3131.12	3335.61	2846.69	3538.23	3025.34
	(65.45)	(67.02)	(74.69)	(78.28)	(69.48)	(67.33)	(69.87)	(70.87)
Fuel	175.96	131.54	134.23	111.80	168.61	179.61	159.6	140.98
	(2.88)	(2.85)	(3.05)	(2.79)	(3.51)	(4.24)	(3.15)	(3.29)
Electricity	194.74	167.26	63.34	62.69	131.00	117.53	129.69	115.82
	(3.19)	(3.61)	(1.44)	(1.56)	(2.72)	(2.78)	(2.45)	(2.65)
Clothing	225.64	129.81	177.40	149.52	181.65	175.67	194.90	151.66
	(3.69)	(2.80)	(4.03)	(3.78)	(3.78)	(4.15)	(3.83)	(3.57)
Education	250.74	97.55	92.92	55.55	141.53	99.70	161.73	84.266
	(4.10)	(2.11)	(2.11)	(1.38)	(2.95)	(2.35)	(3.05)	(1.95)
Health	247.31	187.79	153.71	131.58	205.62	186.04	202.21	168.47
	(4.05)	(4.06)	(3.50)	(3.29)	(4.28)	(4.40)	(3.94)	(3.92)
Other	1016.25	810.28	489.96	357.30	636.61	622.38	714.27	596.65
	(16.63)	(17.52)	(11.15)	(8.93)	(13.26)	(14.72)	(13.68)	(13.36)
Total non-food	2110.64	1524.25	1111.57	868.47	1465.03	1380.95	1562.41	1257.89
	(34.55)	(32.98)	(25.31)	(21.72)	(30.52)	(32.67)	(30.12)	(29.12)
Total	6109.2	4622.46	4392.1	3999.59	4800.64	4227.64	5100.64	4283.23
	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)

The figures in the parentheses show the percentage of consumption in terms of total expenditure (in Taka).

2. Estimation Results and Discussion

The AIDS model as specified in Equation 4.8 has been estimated by OLS in the absence of cross-equation and non-linear restrictions. In the absence of price data[3], we assume that all the households experience the same price. However, when prices are constant, the demand of goods is dependent only on the income of the individual. In that case, the only condition to be met is the adding-up restriction since all the other restrictions are derived from consideration of prices (Beneito, 2003). It is worth mentioning that in this study we have considered adding-up restriction by estimating (n-1) number of equations.

The heteroscedasticity corrected OLS estimates are then obtained using the STATA 8.0 statistical package by applying White corrected Standard errors which is particularly suitable for cross-section data of family budgets. Twelve items that are commonly consumed in rural areas are used for the purpose of estimation.

The households are divided into three groups according to their per capita incomes to see the sign as well as the magnitude of difference in consumption between different groups. As income increases, it is expected that the consumption of staple food item (necessary good) will decrease. By dividing the samples into different income groups we wanted to see the magnitude of changes in consumption between groups. The reason for grouping the sample according to per capita income instead of income is due to the fact that there is wide variation in income among the households. Samples are divided into three equal groups each containing 33.33% of total size and termed as low, medium and high income group.

Table 2 shows OLS estimates of the AIDS model as represented by Equation 4.8. White corrected standard errors are used to correct for heteroscedasticity.

The t-statistics are shown in the parentheses.

The R^2 values suggest that the model fits better for items such as cereals, vegetables, total food and total non-food. Low R^2 is a common observation for the consumer demand behaviour while analysing survey data. The reason may partly be the absence of some factors in the model, which are unobservable and difficult to include. A negative value of expenditure coefficient for any item indicates a necessity and a positive value indicates a non-necessity item.

From Table 2 cereals consumption expenditure is found significant and it is a necessity item for all income groups, as the sign of the coefficient is found negative. This implies that consumption of cereal is more responsive to changes in income for all income groups. A small change in income will cause bigger change in cereal consumption for lower income group people than middle and higher income group people.

Family size is found statistically significant for middle income group. Borrower dummy is found statistically significant for higher income group, which implies that the higher income group borrowers are better off in terms of cereal consumption. We therefore reject the null hypothesis that borrowers' consumption is same as for non-borrowers. District dummy is also found significant which implies that there are variations among districts in cereal consumption; we therefore reject the null hypothesis that the consumption is same across districts.

Pulses and vegetables are necessity for all income groups. The coefficient of pulses and vegetables are also found significant for all income groups. Sugar is found to be a necessity only for the higher income groups. Family size is found significant for pulses consumption

Table 2
OLS Estimation of the AIDS Model for all Districts

	Constant	*Log of total expenditure per capita (LNTEPC)*	*Family Size*	*Borrower dummy*	*District dummy 1*	*District dummy 2*	R^2	*No. of obs*
				Cereals				
Low income per capita	1.25*** (15.93)	-0.16*** (-13.90)	0.0002 (0.11)	-0.001 (-0.26)	0.04*** (4.00)	0.06*** (8.33)	0.65	190
Medium income per capita	1.08*** (15.47)	-0.13*** (-13.07)	-0.004*** (-2.81)	0.002 (0.49)	0.03*** (6.13)	0.04*** (9.01)	0.65	190
High income per capita	0.80*** (19.21)	-0.09*** (-16.05)	-0.001 (-1.35)	-0.013** (-2.31)	0.02*** (4.49)	0.02*** (4.24)	0.67	191
				Pulses				
Low income per capita	0.21*** (6.06)	-0.02*** (-4.43)	-0.0007 (-1.31)	-0.001 (-0.60)	0.002 (0.54)	0.008*** (2.93)	0.17	189
Medium income per capita	0.15*** (4.00)	-0.02*** (-2.67)	-0.0009 (-1.38)	-0.002 (-0.73)	-0.007** (-2.49)	-0.0002 (-0.11)	0.10	183
High income per capita	0.16*** (9.27)	-0.02*** (-6.53)	-0.001*** (-2.67)	-0.008*** (-3.10)	-0.0002 (-0.12)	0.003 (1.22)	0.29	195
				Vegetables				
Low income per capita	0.59*** (8.98)	-0.07*** (-6.53)	-0.006*** (-5.12)	-0.001 (-0.29)	0.02 (0.10)	0.03*** (6.83)	0.47	190
Medium income per capita	0.42*** (6.51)	-0.04*** (-4.37)	-0.007*** (-6.32)	0.0008 (0.25)	0.01*** (2.61)	0.03*** (7.18)	0.36	190
High income per capita	0.49*** (18.71)	-0.05*** (-14.92)	-0.005*** (-7.80)	0.004 (1.46)	0.02*** (5.29)	0.02*** (4.09)	0.60	191
				Sugar				
Low income per capita	-0.07*** (-2.92)	0.01*** (3.63)	0.002*** (4.80)	0.009*** (4.51)	-0.009*** (-2.69)	-0.01*** (-4.91)	0.32	184
Medium income per capita	-0.05 (-1.10)	0.01 (1.61)	0.002*** (3.53)	0.01*** (3.66)	-0.003 (-0.96)	-0.01*** (-3.67)	0.20	184
High income per capita	0.05* (1.75)	-0.002 (-0.54)	0.0003 (0.49)	0.01*** (3.96)	-0.004 (-1.54)	-0.01*** (-3.70)	0.133	183
				Protein (Meat and Fish)				
Low income per capita	-0.29*** (-3.63)	0.05*** (4.55)	0.006*** (4.48)	0.03*** (6.06)	-0.009 (-1.09)	-0.008 (-1.50)	0.32	189
Medium income per capita	-0.39*** (-3.85)	0.06*** (4.40)	0.02*** (6.05)	0.03*** (5.63)	0.00007 (0.01)	0.005 (0.95)	0.41	191
High income per capita	-0.17** (-2.31)	0.04*** (3.61)	0.01*** (4.68)	0.05*** (4.77)	0.009 (1.29)	-0.004 (-0.42)	0.34	190

Contd. table 2

	Constant	*Log of total expenditure per capita (LNTEPC)*	*Family Size*	*Borrower dummy*	*District dummy 1*	*District dummy 2*	R^2	*No. of obs*
				Protein (milk and eggs)				
Low income per capita	-0.03 (1.05)	0.01*** (2.84)	-0.0001 (-0.31)	-0.002 (-0.92)	-0.02*** (-4.98)	-0.009*** (-3.28)	0.15	189
Medium income per capita	-0.009 (-0.23)	0.006 (0.99)	0.003*** (3.90)	0.0007 (0.30)	-0.007 (-1.99)	-0.006** (-2.06)	0.14	183
High income per capita	-0.07** (-2.04)	0.02*** (3.24)	0.002*** (3.25)	0.007 (0.30)	-0.007** (-1.99)	-0.006** (-2.06)	0.14	183
				Cigarettes				
Low income per capita	0.07 (1.64)	0.0002 (0.04)	-0.003*** (-4.71)	-0.008** (-2.42)	-0.002 (-0.38)	0.011*** (3.46)	0.19	166
Medium income per capita	0.03 (0.69)	0.002 (0.24)	0.0009 (0.98)	0.0008 (0.31)	0.006** (2.16)	0.0009 (0.23)	0.02	166
High income per capita	0.16*** (4.58)	-0.01*** (-3.03)	-0.002** (-2.21)	0.006 (1.49)	0.004 (1.32)	-0.008** (-2.47)	0.11	165
				Total food				
Low income per capita	1.73*** (16.91)	-0.16*** (-10.08)	-0.004** (-2.13)	0.02** (2.08)	0.009 (0.75)	0.08*** (8.03)	0.60	190
Medium income per capita	1.59*** (9.42)	-0.14*** (-5.87)	0.005 (1.57)	0.03*** (3.00)	0.02** (2.20)	0.06*** (5.21)	0.31	190
High income per capita	1.65*** (11.60)	-0.14*** (-7.46)	0.003 (0.91)	0.05*** (3.15)	0.05*** (3.74)	0.01 (0.64)	0.29	191
				Fuel				
Low income per capita	0.18*** (3.36)	-0.02** (-2.07)	-0.004*** (-4.21)	0.001 (0.28)	-0.03*** (-4.81)	-0.02 (-4.60)	0.24	190
Medium income per capita	0.16*** (3.93)	-0.02*** (-2.72)	-0.002** (-2.42)	-0.006*** (-2.72)	-0.01*** (-4.42)	-0.008*** (-3.06)	0.19	190
High income per capita	0.10*** (3.25)	-0.008* (-1.90)	-0.002*** (-2.96)	0.003 (1.15)	-0.01*** (-4.57)	-0.009*** (-2.98)	0.21	191
				Electricity				
Low income per capita	0.25*** (8.97)	-0.03*** (-6.90)	-0.003*** (-6.22)	-0.004* (-1.71)	-0.001 (-0.30)	-0.008*** (-3.35)	0.35	134
Medium income per capita	0.17*** (4.15)	-0.02*** (-2.77)	-0.003*** (-4.36)	0.0005 (0.26)	-0.003 (-1.26)	-0.003 (-0.84)	0.23	134
High income per capita	0.13*** (5.38)	-0.01*** (-3.59)	-0.002*** (-5.43)	-0.004** (-2.07)	-0.0002 (-0.14)	-0.002 (-0.97)	0.23	133

Contd. table 2

	Constant	*Log of total expenditure per capita (LNTEPC)*	*Family Size*	*Borrower dummy*	*District dummy 1*	*District dummy 2*	R^2	*No. of obs*
				Education				
Low income per capita	0.07 (1.33)	0.001 (0.14)	-0.004*** (-3.69)	-0.005 (-1.24)	-0.02** (-2.22)	-0.01 (-3.31)	0.18	94
Medium income per capita	0.02 (0.34)	0.006 (0.67)	-0.003*** (-2.83)	-0.003 (-0.66)	-0.005 (-0.99)	0.0002 (0.06)	0.06	94
High income per capita	-0.15** (-2.26)	0.02*** (2.98)	-0.001 (-1.65)	0.003 (0.44)	0.005 (0.90)	0.01* (1.84)	0.14	94
				Cloth				
Low income per capita	-0.01 (-0.52)	0.006 (1.66)	0.0002 (0.58)	0.002 (1.59)	-0.004 (-1.44)	0.004 (92.35)	0.07	190
Medium income per capita	0.06*** (2.84)	-0.005 (-1.46)	0.0004 (0.71)	0.003** (2.30)	-0.005*** (-3.12)	0.004 (2.17)	0.20	190
High income per capita	0.05** (2.16)	-0.001 (-0.43)	-0.0001 (-0.29)	0.004 (1.71)	-0.002 (-1.35)	0.008** (2.16)	0.14	191
				Health				
Low income per capita	-0.02 (-0.74)	0.01** (2.22)	0.0003 (0.67)	-0.003 (-1.27)	0.005 (0.66)	-0.006** (-2.31)	0.11	185
Medium income per capita	0.0009 (0.02)	0.006 (0.70)	-0.0007 (-0.82)	0.003 (0.71)	-0.004 (-0.78)	-0.007** (-2.59)	0.02	185
High income per capita	0.09** (2.47)	-0.003 (-0.79)	-0.003*** (-3.83)	-0.002 (-0.48)	-0.005 (-1.31)	-0.002 (-0.51)	0.08	186
				Total non-food				
Low income per capita	-0.73*** (-7.16)	0.16*** (10.08)	0.004** (2.13)	-0.02** (-2.08)	-0.009 (-0.75)	-0.08*** (-8.03)	0.60	190
Medium income per capita	-0.59*** (-3.51)	0.14*** (5.87)	-0.005 (-1.57)	-0.03*** (-3.00)	-0.03** (-2.20)	-0.05*** (-5.21)	0.31	190
High income per capita	-0.65*** (-4.58)	0.14*** (7.46)	-0.003 (-0.91)	-0.05*** (-3.15)	-0.05*** (-3.74)	-0.01 (-0.64)	0.29	191

(***) Significant at 1 percent level, (**) Significant in 5 percent level, (*) Significant in 10 percent level and the t-statistics are shown in the parentheses.

only for the higher income group, while, family size is found significant for vegetable consumption for all income groups. In case of sugar consumption, family size is significant only for low and middle income group people. As family size increases sugar consumption will also increase for low and medium income group people. Borrower dummy is found significant for pulses consumption for the higher income group. This implies that the higher income group borrowers are better off in terms of pulses consumption. Borrower dummy is found significant for all income groups in case of sugar consumption. Significant district dummy shows that there is a variation in consumption of vegetables, pulses and sugar between districts.

Protein consumption is divided into two categories. Beef, mutton, chicken and fish of all types are estimated separately than milk and eggs. For all income groups' protein is found to be a significant and non-necessary item. Protein consumption is found responsive to changes in income for all income groups. For the higher income group bigger changes in income will cause smaller changes in protein consumption. This implies the higher income group is more saturated in protein consumption. In terms of protein consumption family size is found significant and positive. This implies that as family size increases, protein consumption will also increase. District dummy is found significant in case of milk and eggs consumption across different income levels.

Borrower dummy[4] is found significant for all income groups in case of meat and fish consumption. This implies that there is a difference in consumption of meat and fish between borrowers and non-borrowers. Protein (meat and fish) is considered as an expensive food item compared to other food items in rural Bangladesh. Our results suggest that the microcredit borrowers are better off in terms of protein consumption. From these results we may conclude that the microcredit programs are doing well in providing better consumption for borrowers. We have emphasised this point since we found significant borrower dummy for all income groups. If borrower dummy was significant, only for the higher income group borrowers, a question may arise regarding whether only higher income group people are microcredit borrowers.

Cigarettes, betel leaf and betel nuts are found significant and necessary for higher income group people. Demand for total food is found significant in all income groups and more responsive to changes in income. For the lower-income group it decreases at a higher rate than the higher-income group. Significant district dummy shows there is a difference in total food consumption across districts.

Borrower dummy is found significant for all income groups for total food consumption. This implies that there is a difference in total food consumption between borrowers and non-borrowers. This further implies that borrowers are better off in terms of total food consumption. This result reinforces our previous suggestion that the microcredit programs are successful in bringing better consumption for borrowers.

Fuel and electricity are found significant and necessity items. Family size is significant for both fuel and electricity consumption. District dummies are found significant for fuel consumption but not for electricity. In case of fuel consumption borrower dummy is significant only for the middle income group people while the same dummy is significant for low and high income group people in case of electricity consumption.

Education is found non-necessary but significant for higher income group people. This may be due to free primary education in rural Bangladesh. Clothing is found necessary for middle and higher income group people, but not for the poor people. On the other hand expenditure on health is found to be a necessary item only for the higher income group but not necessary for the lower and middle income group.

Total non-food items are found non-necessary for all income group people. Borrower dummy is found significant only for the total non-food item but not for education, clothing or health (that compose total non-food). This implies there is no difference between borrowers and non-borrowers in terms of consumption on education, clothing and health. The significant coefficient of total non-food item for borrowers may be due to more spending on electricity by borrowers.

On the other hand, district dummy is found significant for items such as clothing, education at the 10% and 5% levels respectively, and health at the 5% level. The district dummy is found significant for total non-food item implies that there is difference in consumption of these items among districts.

Budget share on food items especially meat, fish and eggs are found significant which is consistent with Deaton's result based on British data and Ray's result based on Indian data on rural areas. The absence of a significant coefficient for clothing, contrasts with Deaton and Ray both.

To examine the robustness of these results an alternative model has been estimated here where the samples are not divided into groups but income dummies are used instead.

The model is as follows:

$$B_i = \alpha_i + \beta_i \log x + \delta_i \log f + \gamma_i BD + \pi_i DD_1 + \chi_i DD_2 + D_1 + D_2 + \varepsilon_i \quad (9)$$
$$\forall_i = 1, 2.....12$$

where $D_1 = 1$ for the low income group and zero otherwise,

$D_2 = 1$ for the middle income group and zero otherwise.

Similar results are obtained from this model so we are not reporting the results here.

3. Test for Significant Difference between Borrowers and Non-borrowers

The model that has been estimated in the previous section assumes that the qualitative variables (dummy variables) affect the intercept but not the slope coefficient of the various subgroup regressions. But what if the slopes are also different? If the slopes are in fact different, testing for differences in the intercepts may be of little practical significance. Therefore, it is necessary to develop a general methodology to find out whether two regressions are different, where the difference may be in the intercepts or the slopes or both.

In so doing, the following equation is estimated.

$$B_i = \alpha_i + \beta_i X + \delta_i \log f + \gamma_i BD + \lambda_i X^* BD + \pi_i DD_1 + \chi_i DD_2 + \varepsilon_i \quad (10)$$
$$\forall_i = 1, 2.....12$$

To see the implications of the above model as mentioned in Equation (10), and assuming that $E(u_i) = 0$, we obtain

$$E(B_i \mid BD = 0, \quad X) = \alpha_1 + \beta_1 X$$
$$E(B_i \mid BD = 1 \ \ X) = (\alpha_1 + \gamma_1) + (\beta_1 + \lambda_1)X$$

These are respectively the mean consumption functions for the regression model. The intercept coefficient as well as the slope coefficient is different as the dummy takes the value of zero and one. It is worth mentioning that the introduction of the dummy variable BD in the multiplicative form (D multiplied by X) enables us to differentiate between the slope coefficient of borrowers and non-borrowers, just as the introduction of the dummy variable in the additive form enables us to distinguish between the intercepts of the two groups.

Table 3 shows the OLS estimation using the differential slope coefficient. It has also been tested whether the coefficient of the borrower dummy and the multiplicative term are jointly zero through coefficient tests of Wald coefficient restrictions.

From Table 3 it is observed that the intercept coefficient for all food items except for milk and eggs and all non-food items except for clothing are statistically significant. By looking at the slope coefficient it is evident that items such as cereals, protein (both types) fuel, education, total food and total non-food are statistically significant. The income elasticity of items such as cereals, vegetables, sugar, fuel, electricity, total food and non-food items for non-borrowers are found steeper than borrowers, which implies small changes in income will cause a bigger change in consumption for non-borrowers. This inelastic function implies that cereals, vegetables, sugar, fuel, electricity, total food and non-food items are necessary items for non-borrowers.

Table 3
Testing for Differential Slope-coefficient

	Constant	*Log of total expenditure per capita (LNTEPC)*	*Family size*	*Borrower dummy (BD)*	*LNTEPC *BD*	*District dummy 1*	*District dummy 2*	*Test of restriction vector* $\gamma_i = \lambda_i = 0$ *(F-statistics)*	R^2
Cereal	1.10*** (21.38)	-0.13*** (-17.59)	-0.02*** (-2.85)	-0.08 (-1..62)	0.01* (1.65)	0.03*** (7.80)	0.05*** (11.12)	1.41 [0.24]	0.80
Pulses	0.16*** (7.38)	-0.02*** (-4.97)	-0.004** (-2.15)	0.03 (1.25)	-0.004 (-1.39)	-0.001 (-0.88)	0.004*** (2.72)	3.98 [0.02]	0.38
Vegetables	0.60*** (16.38)	-0.06*** (-12.91)	-0.035*** (-9.35)	-0.03 (-0.85)	0.004 (0.91)	0.02*** (6.26)	0.03*** (10..38)	0.89 [0.41]	0.64
Sugar	-0.08*** (-5.18)	0.02*** (6.78)	0.01*** (4.70)	0.03* (1.86)	-0.003 (-1.21)	-0.005*** (-2.85)	-0.01*** (-8.01)	32.48*** [0.00]	0.33
Protein (meat and fish)	-0.48*** (-9.33)	0.07*** (10.44)	0.06*** (9.89)	-0.01 (-0.29)	0.007 (1.00)	0.001 (0.35)	-0.0002 (-0.07)	55.053*** [0.00]	0.59
Protein (milk and eggs)	-0.03 (-1.52)	0.01*** (3.67)	0.009*** (3.43)	-0.08*** (-3.81)	0.01*** (4.01)	-0.007*** (-3.59)	-0.007*** (-3.75)	11.23*** [0.00]	0.26
Cigarettes	0.11*** (3.77)	-0.006 (-1.58)	-0.009*** (-3.03)	-0.05* (-1.86)	0.008* (1.87)	0.006*** (2.66)	0.003* (1.68)	1.76 [0.17]	0.05
Total food	1.53*** (16.64)	-0.13*** (-9.56)	-0.002 (-0.23)	-0.18** (-1.98)	0.03** (2.39)	0.04*** (4.57)	0.05*** (8.95)	22.60*** (0.00)	0.45
Fuel	0.18*** (7.18)	-0.01*** (-4.62)	-0.01*** (-6.60)	-0.03* (-1.76)	0.005* (1.82)	-0.01*** (-8.12)	-0.01*** (-5.92)	1.94 [0.14]	0.23
Electricity	0.21*** (9.99)	-0.02*** (-7.58)	-0.02*** (-8.65)	-0.02 (-1.16)	0.003 (1.17)	-0.002* (-1.81)	-0.005*** (-3.09)	0.69 [0.50]	0.38
Education	0.09** (2.37)	-0.004 (-0.72)	-0.01*** (-3.49)	-0.11*** (-2.74)	0.02*** (2.67)	-0.003 (-0.94)	-0.001 (-0.50)	4.22** [0.02]	0.08
Cloth	-0.001 (-0.08)	0.005*** (2.61)	-0.0002 (-0.17)	-0.01 (-0.78)	0.002 (1.10)	-0.005*** (-4.33)	0.004*** (4.36)	11.04*** [0.00]	0.15
Health	0.05** (2.16)	-0.0001 (-0.02)	-0.007*** (-2.65)	0.003 (0.14)	-0.0009 (-0.22)	-0.004* (-1.88)	-0.007*** (-4.44)	0.79 [0.45]	0.04
Total non-food	-0.53*** (-5.80)	0.13*** (9.56)	0.002 (0.23)	0.18** (1.98)	-0.03** (-2.39)	-0.04*** (-4.57)	-0.05*** (-8.95)	22.60*** [0.00]	0.45

(***) Significant at 1 percent level, (**) Significant in 5 percent level, (*) Significant in 10 percent level. The t-statistics are shown in the parentheses and probabilities are shown in the square brackets.

On the contrary, it is observed that items such as pulses, meat, fish, eggs, milk and clothes reveals a more inelastic (steeper) function for borrowers. Therefore, it can be concluded that for borrowers' items such as pulses, meat, fish, eggs, milk and clothes are necessary items. It is worth mentioning here that these are relatively expensive items compared to other food and non-food items in rural Bangladesh. According to our findings, once borrowers find such items (pulses, meat, fish, eggs, milk and clothes) as necessary, it can be concluded that microcredit programs must be doing well in providing better consumption for borrowers. Thus the findings from Table 3 are consistent with the results of Table 2.

From Table 3 it is observed that the intercepts as well as the slopes of the demand functions are different for both food and non-food items. Therefore, the result strongly indicates that there are significant difference between borrowers and non-borrowers in terms of consumption of the items. For testing the values of the coefficient whether jointly zero or not we develop the null hypothesis $\gamma_i = \lambda_i = 0$. The coefficient test result shows statistically significant coefficient for items such as sugar, protein, education, clothing, total food and total non-food. We therefore reject the null hypothesis that the coefficients are jointly zero.

VI. CONCLUSION

This is the first study that investigates the impact of per capita monthly expenditure on budget share of different items consumed by borrowers of different income groups using AIDS model. This study has used quasi-experimental approach by comparing consumption patterns of microcredit borrower with non-borrowers of non-program villages.

Twelve consumable items commonly used in rural Bangladesh are used for the purpose of estimation. The total sample is divided into three equal groups according to their income per capita to determine the difference in consumption between different income groups. A test of significant difference between borrowers and non-borrowers is considered along with the coefficient test.

From the analysis it is observed that cereals, pulses, vegetables, fuel and electricity are found to be necessity items for all income groups. Sugar, cigarettes, clothing and health are found to be a necessity only for the high income group people but not for the low or middle income group people. Meat, fish, milk and eggs are found significant for all income groups which is consistent with Deaton's result based on British data, and Ray's result based on Indian data. Total food is found statistically significant for the borrowers and the coefficient becomes smaller with respect to the higher income level.

It may be derived from the analysis that there is a difference in consumption between different income group people. Consumption of cereals is more responsive to changes in income for all income groups, but for the lower income group cereals consumption falls at a faster rate with respect to income than for the middle and higher income group. A small change in income will cause bigger change in cereals consumption for the lower income group people than the middle and higher income group people. Protein consumption is found responsive to changes in income for all income groups. For the higher income group bigger changes in income will cause smaller changes in protein consumption. This implies that the higher income group is more saturated in protein consumption. The statistically significant coefficient of total food for borrowers (which is also smaller with respect to

higher income group) implies that as income increases, the proportion of expenditure on total food becomes smaller for the higher income group compared to the lower income group. Similar results are obtained from total non-food items.

Borrower dummy is found significant in case of cereals, pulses and electricity for the high income group. From this it may be concluded that borrowers are better off in terms of food and non-food consumption and higher income borrowers are better off in some items than the low income borrowers. Borrower dummy is also found significant for sugar, protein, total food and total non-food for all income groups. This result suggests that borrowers of all income levels are better off in terms of consumption of such (relatively expensive) items. Our results further suggest that microcredit programs are making it possible for borrowers to consume comparatively expensive food and non-food items and have a better quality of life.

In most of the food items except for meat and fish district dummies are found significant. Significant coefficients are found in case of all non-food items except for education, health and clothing. This suggests that there is difference in consumption in terms of most of the items between different districts.

From the results of the differential slope coefficient test, it is found from the inelastic demand curve that items such as cereals, vegetables, sugar, fuel, electricity, total food and non-food are necessary for non-borrowers. On the other hand, for borrowers, items such as pulses, meat, fish, eggs, milk and cloth are found necessary, which is demonstrated from the inelastic demand curve of the items.

From the result of the joint coefficient test, it is evident that there is a difference in consumption between borrowers and non-borrowers. Borrowers as a whole are better off in terms of consumption of all food items and some non-food items such as fuel and electricity. Interestingly, higher income group borrowers are found statistically significant and better off in terms of consumption of few food items and total non-food items.

In terms of vegetables, fuel and electricity consumption there is no difference between borrowers and non-borrowers while in terms of clothing consumption it is found that borrowers are better off. In terms of expenditure on health and education, we found no difference between borrowers and non-borrowers but there is difference between districts in terms of expenditure on education and health.

In summary we may conclude that microcredit borrowers are better off in terms of consumption of most of the food and non-food items compared to non-borrowers. Borrowers of all income levels are better off in consumption of expensive food items. These results suggest that microcredit programs are successful in bringing better consumption for borrowers. The programs are able to make borrowers afford relatively expensive food and non-food items. Our results further suggest that microcredit programs are doing well enough to produce better quality of life for borrowers by providing better consumption. Since borrowers of *all income levels* are demonstrating better consumption on most of the expensive food items, show *the positive impact of microcredit programs on consumption.* We can not conclude that the higher income borrowers are better off as we have found significant coefficient of two items (cereals and pulses) only for that group. Apart from credit, we do not have enough information to identify other factors that may have impacted better consumption for borrowers.

Notes

1. Rahman (2006), accepted for publication in the *Journal of Developing Areas*.
2. The questionnaire would be available upon request.
3. Since we use cross-section data over a period of time it is assumed that the price of the items has not changed during that period among the districts.
4. The coefficient of the variable (borrower dummy) may be little higher in the absence of Heckman's two-stage procedure.

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