

# Measuring Household Economic Status in Rural Bangladesh: Can Asset Based Indicators Replace Household Income and Expenditure?

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## Abstract

*This study aims to assess whether an asset based index of economic status correlates better with indices of health and social deprivation than do household income and expenditure. Two sets of data were used to investigate this-Matlab Health and Socioeconomic Survey 1996 and Socioeconomic Census Matlab, 1996. Results show that household assets are significantly correlated with household income and consumption expenditure, but the correlation with expenditure ( $r^2$  0.32) is higher than with income ( $r^2$  0.10). In the case of inequality, children's nutritional status and their educational enrollment are not significantly correlated with household income, but they are significantly and consistently correlated with household assets and expenditure. Among all the economic indicators, household assets show larger inequality (measured by poor: rich ratio) in these health and social outcomes.*

## Background

Measuring household economic status in developing countries receives a lot of attention from both researchers and policymakers, because many studies have shown that the household economic status is highly correlated with household and individual well-being. One of the main objectives of all development projects is to maximize the welfare of the people through extending its services to the most deprived section of the people. A prerequisite for achieving this goal is the accurate measurement of household economic status to identify those who are at highest risk of deprivation in the society.

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Defining household economic status in developing countries poses considerable problems. Data on two frequently used indicators of household economic status, household income and expenditure levels are often unavailable and unreliable (Houweling 2003). Moreover in developing countries where income is mainly derived from self-subsistence agriculture or informal sectors, expressing income in monetary terms is both difficult and unreliable (Rahman 1996, Falkingham and Namazie 2002, Houweling 2003). Comparing to data on income, household expenditure data are easier to gather. But expenditure data are subject to a different set of problems. Income for the majority of people is a regular flow of money. Expenditure, however, may be irregular. In most developing countries, expenditure data are usually collected in surveys on the basis of recall of one week, two weeks or a month. But recall data are prone to large measurement errors (Falkingham and Namazie 2002).

Given the problems in measuring income and expenditure researchers are increasingly trying to identify alternative measures of household economic status that are robust but less data intensive and subject to smaller measurement errors. Recent research using the Demographic and Health Surveys has used data on ownership of assets and access to services to derive alternative indicators of household economic status. This idea was mainly developed by the World Bank to create tool to measure the relative economic position of households. Many health equity studies are now using asset index as a tool for household socio-economic status (Gwatkin 2000, Kington and Smith 1997).

The issue of comparing assets indicators as proxies for household income or expenditure has not been intensively addressed. The studies that have been conducted have given variable findings. Montgomery et al (2000) evaluated the performance of proxy measures commonly used in demographic studies employing data from the DHS in relation to consumption expenditure per adult. They found that the proxy variables were weak predictors of consumption per adult. However, in subsequent analyses of fertility, child schooling and mortality, the proxy-based coefficient estimates compared favorably to those obtained using consumption. Sahn and stifel (2001), also found the correlation of their asset index with household expenditure to be weak.

In contrast, Filmer and Pritchett (1999), concluded that the asset index had reasonable coherence with current consumption expenditures and worked as well or better, than traditional expenditure-based measures

in predicting educational enrollment status. Wagstaff and Watanabe (2002), also found little difference in the correlation between child malnutrition and economic status using consumption or an asset based wealth index. Setel et al. (2003), using data from three regions in Tanzania from the DSS of adult Mortality and Morbidity project, concluded that the proxy variables were good predictors of expenditure. Morris et al. (1999), found that the wealth proxy correlated highly with the more complex monetary value of assets ( $r=.74$ ). But they did not explore any direct correlation between household wealth and expenditure.

Houweling et al. (2003) compared the world Bank asset index with three other wealth indices, all based on household assets to see the extent to which different measures of economic status correlate with health indicator. Comparing the World Bank index to the alternative indices, they found that the relative positions of households in the national wealth hierarchy varied according to asset index used: observed poor-rich inequalities in under-5 mortality and immunization coverage often changed, in some cases to an important extent: and that the size and direction of this change varied per country, index and health indicator. In a similar type of study, Bollen et al. (2002), focused on how the choice of proxy measures for economic status influenced the predicted effects of other explanatory variables on fertility. They concluded that if the focus is on economic status itself, than the choice of proxy can make a difference. If however, attention lies on other variables and economic status is being used as a control, then the non-economic status variables are relatively robust to the choice of proxy.

Thus the results of existing studies do not give consistent findings regarding the validity of various proxy measures in determining household socioeconomic status. Though existing studies attempted to validate asset based proxy indicators against household expenditure, they failed to address the validation of alternative indices against income due to lack of available data on household income.

In Bangladesh, exploring household assets and access to services as proxies for household income and expenditure has not been well addressed. Consequently, this study attempted to address this issue in Matlab a rural area in Bangladesh. This attempt used detailed data on household income and expenditure from a large sample of 4364 household gathered by Matlab health & Socioeconomic Survey (MHSS), 1996. In addition, Matlab Socioeconomic Census 1996 had data on household assets and access to services for a sample of 39895 household,

where the same households of MHSS Survey were also included. MHSS 1996, also contained detailed information of health and social variables. This study attempted to measure the extent of inequalities in health and social outcomes by different measures of household status to examine which indicator can best measure inequality.

### **Objective of the Study**

The main objective of the study is to examine the strength of the asset based alternative indices of household socio-economic status, as proxies for household income and expenditure in two ways: 1) by comparing household income, consumption expenditure and assets; 2) by examine the extent of inequalities in school enrollment of children and their nutritional status by different SES measures.

### **Population and Methods**

Two sets of data have been used for the study: the Matlab Health and Socio-Economic Survey (MHSS) 1996 and the Socio-Economic Census (SES) of Matlab 1996. Matlab Health and Socio-Economic Survey, a major family and community Survey was carried out in Matlab, a region of rural Bangladesh in which there is an ongoing prospective Demographic Surveillance System, under the aegis of the International Center for Diarrheal Disease Research, Bangladesh (ICDDR,B). The MHSS addressed the several broad areas of concerns to the rural child, adult and elderly: the effect of socio-economic and behavioral factors on child, adult and elderly health status, and health care utilization: the linkages between adult/elderly well-being, social and kin network characteristics and resource flows; and the impact of community services and infrastructure on adult / elderly health and other human capital acquisition. In the context of socio-economic characteristics, the survey collected large amount of information on household income, household consumption expenditure, land transaction, household economic hardship and lending history. The main survey consisted of household and individual-level information on 4364 household clustered in 2687 baris or residential compounds, an approximately one-third random sample of the total number of baris in the surveillance area.

Socio- economic Census is a periodical part of the Demographic Surveillance System at Matlab of ICDDR,B. The Demographic Surveillance in Matlab has been operating since 1966. With continuing registration of birth, death, migration, marital union and dissolution, inter-village movement, household split and household head change etc. The surveillance system also conducts periodical censuses on other socio-

economic event. The total number of household covered in 1996 Socio-economic Census was 39895 in 142 villages. The census covered a wide range of socio-economic data on households possession of land and other durable assets, dwelling size, building materials of the rooms, toilet facilities, sources of water , occupation of the household members; household remittance and transfers and women status.

For this analysis, data on household income, consumption expenditure and children's educational and nutritional status have been extracted from MHSS 1996. Information on households' ownership of different assets and access to different services has been taken from SES 1996.

After matching the two data sets, we obtained a sample of 4275 households as the unit of the analysis.

### **Calculation of Income, Expenditure and Asset Score**

#### ***Income***

MHSS 1996 gathered detailed information on household income over one year from all possible sources. The sources of income are divided into five broad categories-incomes from cultivation; income from sale of products, goods and assets; income from rent; income from employment; and income from transfer. Following the standard procedure of Bangladesh Bureau of statistics (BBS), in calculating income, gross revenue from each income source has been considered. To get the real income of the households for the year of 1996, the expenses needed to produce the gross income has been subtracted from the gross revenue. Once the household income has been calculated, the whole sample has been divided into quintiles based on income and ranked from through lowest to highest. (Table 1)

Some households (110), in the sample, had negative income for the year 1996 as total expenditure needed to generate the gross income outweighed the gross revenue, (figure 1)

Figure 1: Distribution of Household Income

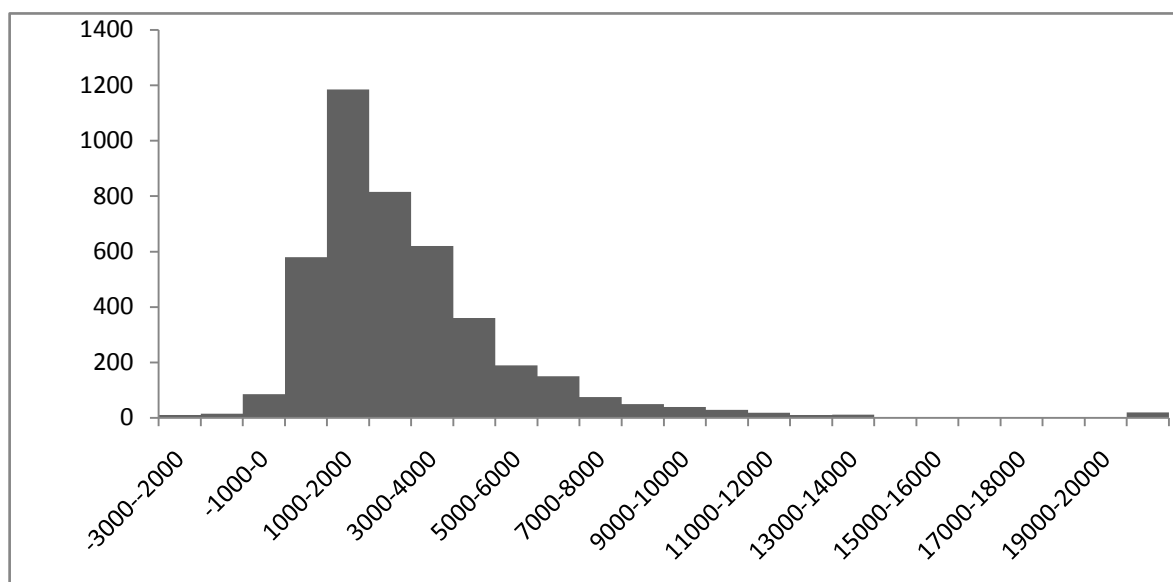


Table 1: Cut-off Points for Income Quintiles

Income Quintiles	Monthly Income (in TK)
Poorest Quintile	<711
2nd Quintile	711-1417
3rd Quintile	1417-2420
4th Quintile	2420-4140
Richest Quintile	4140<

### ***Expenditure***

Household consumption expenditure has been calculated by aggregating the value of household consumption and certain other outlays of the household. Three broad sectors of household expenditure were considered (I) expenditure on food item which included the value of different items of foods consumed during the past week; (II) expenditure on non-food items which included one year expenditure on clothing, kitchen equipment, household textiles, repair and maintenance of house, gift for ritual ceremonies, charities, dowry, legal expenses and one month expenditure on toiletries, fuel, medicine and medical services, transport costs; and (III) expenditure on education which included monthly expenditure for tuition and pocket money for education, food and lodging for education and one year expenditure for expenditure for school uniforms, school supplies, registration fees etc. To calculate monthly household expenditure one week and one year expenditure has been transformed into one month expenditure. Like previous cases, households have been divided into five equal groups and ranked on the basis of consumption expenditure (Table 2)

Figure 2: Distribution of Household Expenditure

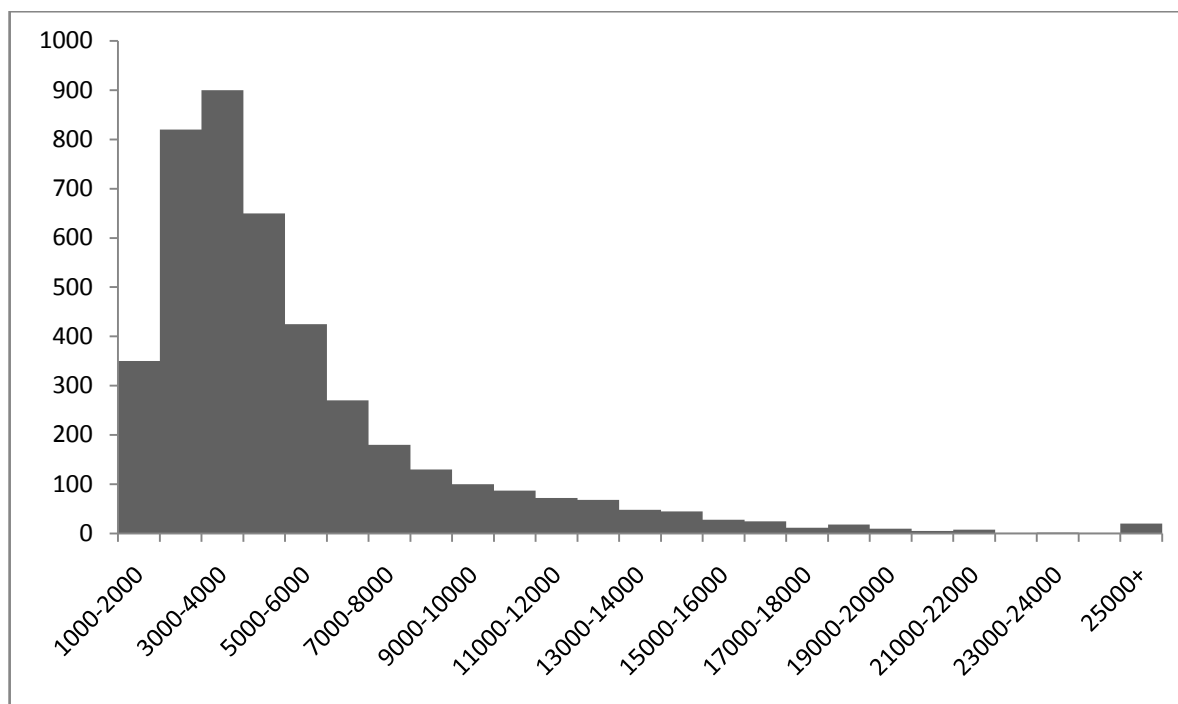


Table 2: Cut-off Points for Expenditure Quintiles

Expenditure Quintile	Monthly Expenditure (in TK)
Poorest Quintile	<2173
2nd Quintile	2173-3063
3rd Quintile	3063-4188
4th Quintile	4188-6261
Richest Quintile	6261<

### ***Asset Score***

Asset score has been calculated through principal component factor analysis as proposed by the World Bank. All variables were considered as dichotomous, that is whether a household own a particular asset or not, except land ownership and dwelling size. These have been kept as continuous because quantity of land and dwelling size are important factors of household socio-economic status that tends to vary largely among households than other durable assets. Through the Principal Component Analysis, each household asset is assigned a weight or factor score. The resulting asset scores are standardized in relation to a standard normal distribution with a mean of zero and standard deviation of one. The standardized scores are then used to create the break points that define wealth quintiles. Each household is assigned a standardized score for each asset, where the score differed depending on whether or not the household owned that asset (or in case of land, the amount of the land

and in case of dwelling size, total area of dwelling). These scores were summed for each household to get the final HH asset score.

Table 3 presents information about the assets used in the calculation of the asset index and wealth quintiles. The first column on the left hand side provides a brief description of each asset. The following two sets of columns present descriptive statistics for the asset, namely unweighted proportion of all sample households that owns each asset (and the standard deviation of the proportion): and the percentage of the sample population in each wealth quintile of the population that owns each asset.

The column labeled “Asset Factor Scores” presents the raw factor scores for each asset generated by the Principal Component Analysis, as explained before. The right-hand pair of columns presents the calculated standardized household asset scores (See Gwatkin 2000).

Initially 39 assets were considered and in this case the variance explained by the first factor was 16.2 percent. In the second phase, assets that gained insignificant factor loadings have been omitted (Stevens 1986) to get smaller number assets to calculate the final asset score. Out of 39 assets 22 assets have a significant factor loading and in final stage these 22 assets have been considered for extraction, where variance explained by the first factor is 25.3 percent.

Table 3: List of Assets and Factor Scores

Asset variables	Unweighted Mean	Unweighted Std. Deviation	Quintiles (percentage)						Asset Factor Score	HH Score if Has Asset	HH Score Has not Asset
			Poorest	Second	Third	Fourth	Richest	Total			
Ownership											
Khat	0.2618	0.4396	0.0	3.6	12.6	34.2	80.5	26.2	0.119	0.20	-0.07
Quilt	0.6246	0.4843	1.8	35.4	77.4	97.9	99.8	62.5	0.129	0.10	-0.17
Mattress	0.4793	0.4996	0.5	10.5	44.9	84.8	98.9	47.9	0.127	0.14	-0.13
Hurricane	0.9022	0.2970	67.0	90.9	95.4	98.6	99.2	90.2	0.061	0.02	-0.19
Watch/Clock	0.5775	0.4940	2.3	29.9	66.0	91.3	99.2	57.8	0.127	0.11	-0.15
Chair	0.6112	0.4875	2.0	36.1	73.7	94.2	99.6	61.1	0.127	0.10	-0.16
Almirah	0.3525	0.4778	3.9	14.5	28.3	49.5	80.1	35.3	0.104	0.14	-0.08
Radio	0.4727	0.4993	1.3	16.7	43.6	77.8	97.0	47.3	0.128	0.13	-0.12
TV	0.0493	0.2116	0.2	0.2	0.1	1.5	22.6	4.9	0.076	0.33	-0.02
Bike	0.0334	0.1798	0.1	0.7	0.9	3.7	11.2	3.3	0.042	0.22	-0.008
Cows	0.3757	0.4844	19.3	33.8	40.1	48.9	45.7	37.6	0.035	0.05	-0.03
Electricity	0.1144	0.3183	0.7	3.0	6.8	13.1	33.6	11.4	0.071	0.20	-0.03
Roof pacca	0.0049	0.0699	0.0	0.0	0.0	0.0	2.5	0.5	0.035	0.49	-0.003



Roof tin	0.9605	0.1949	86.3	97.4	99.6	99.6	97.2	96.0	0.025	0.005	-0.11
Wall pacca	0.0189	0.1364	0.0	0.2	0.1	0.6	8.5	1.9	0.053	0.38	-0.007
Walltin	0.291	0.4543	0.5	7.1	14.2	44	79.2	29.1	0.108	0.17	-0.07
Female use septic tank	0.0418	0.2003	0.1	0.7	0.8	2.8	16.5	4.2	0.059	0.28	-0.01
Female use water seal latrine	0.1813	0.3853	2.2	5.6	10.6	25.8	46.3	18.1	0.071	0.15	-0.03
Female use open latrine (pacca/tin)	0.1202	0.3253	3.9	8.4	10.3	16.5	21.1	12.0	0.031	0.08	-0.01
Drink tube well water	0.9488	0.2205	90.6	93.1	94.6	97.1	98.9	94.9	0.029	0.007	-0.12
Total land possess by the HH in decimals	82.96	129.91	...	...	...	...	...	...	0.102	...	...
Total floor space in sq. feet	307.77	187.39	...	...	...	...	...	...	0.128	...	...

The percentage of covariance explained by the first principal component is 25 percent. The first eigenvalue is 5.561, the second eigenvalue is 2.132.

Table 4: Cut-off Points for Asset Quintiles

Asset Quintiles	Household Asset Score
Poorest Quintile	<-.9880
2nd Quintile	-0.5428
3rd Quintile	-0.2034
4th Quintile	.2418-.9396
Richest Quintile	.9396<

### ***Health Status and School Enrollment***

For the health indicator weight for age of children less than 5 years of age is considered. Normal and mild underweight is regarded as 'Normal Weight' and moderate and severe under weight was regarded as 'Under Weight'. For the schooling indicator whether children of 6-14 years of age ever attended school or were attending school is considered.

## Result

### *Extent of Similarity among Different SES Indicators in Determining Household Socio-economic Status.*

To compare asset based alternative indicators against household income and expenditure, individual household is ranked according to different economic indicators. The strength of proxy indicators depends on whether a particular household ranked as same socioeconomic category by assets as by income and expenditure.

Table 5 and Table 6 show the extent of similarity between ranking based on asset score and on household income/expenditure in determining household socio-economic status. Table 5 indicates that among households, which are in the poorest quintile according to asset index, about 26 percent remain in the same quintile of income index. Of households, which are in the richest quintile on the basis of asset index, 44 percent remain in the same quintile according to income index and about 22 percent fall into the poorest two quintiles of income index.

Table 5: Changes of households to other status quintiles when using asset index compared to income index

		Income Quintiles (%)					
		Poorest	Second	Third	Fourth	Richest	Total
Asset Quintiles (%)	Poorest	26.4	29.9	21.1	14.9	7.7	100 (n= 855)
	Second	22.0	25.6	23.7	19.2	9.5	100 (n= 855)
	Third	21.4	18.7	24.8	22.0	13.1	100 (n= 855)
	Fourth	18.5	15.8	17.4	22.8	25.5	100 (n= 855)
	Richest	11.7	9.9	13.3	20.8	44.2	100 (n= 855)

In contrast, comparing asset index with expenditure index (table 6) indicates larger similarity among quintiles. In this case households which belong to poorest quintile according to asset index, about 45 percent belong to the same group according to expenditure index. Displacement among extreme quintile is also low. About 11 percent of the households of poorest category by asset index have been displaced to highest two categories by expenditure index and about 10 percent of the households in highest category by asset index, have been transformed to lowest two categories by expenditure index. Moreover, of households, which are in the richest quintile on the basis of asset index, 54 percent remain in the same quintile according to expenditure index (which is 10 percent higher compared to income index).

Table 6: Changes of households to other status quintiles when using asset index compared to expenditure index.

		Expenditure Quintiles (%)					Total
		Poorest	Second	Third	Fourth	Richest	
Asset Quintiles (%)	Poorest	44.6	28.5	15.7	8.4	2.8	100 (n= 855)
	Second	26.9	27.8	24.3	14.3	6.7	100 (n= 855)
	Third	17.5	21.2	27.4	22.9	11.0	100 (n= 855)
	Fourth	8.3	15.7	21.8	28.8	25.5	100 (n= 855)
	Richest	2.7	6.8	10.9	25.3	54.0	100 (n= 855)

Figure 3, 4 and 5 show the individual value of these measures. The household asset score correlates better with household consumption expenditure than with household income. This is also the case for food expenditure, non-food expenditure and educational expenditure. Household income is only weakly correlated with household expenditure (table 7).

Table: 7 Correlation Matrix

Variables	1	2	3	4	5	6
Asset Score	1.00					
Income	.302**	1.00				
Consumption Expenditure	.567**	.309**	1.00			
Expenditure on Food	.481**	.287**	.881**	1.00		
Expenditure on Non-Food Item	.525**	.269**	.866**	.602**	1.00	
Expenditure on Education	.540**	.192**	.582**	.408**	.477**	1.00

Figure: 3 Association between Household Assets and Household Income

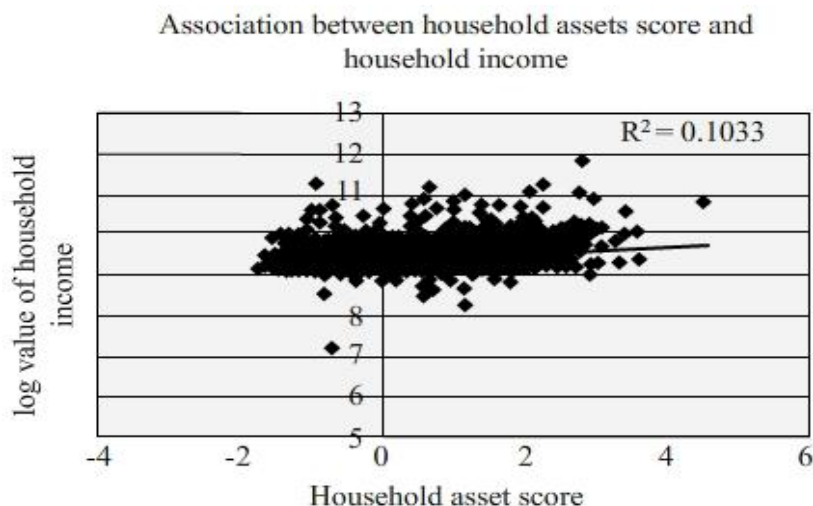


Figure 4: Association between Household Income and Household Expenditure

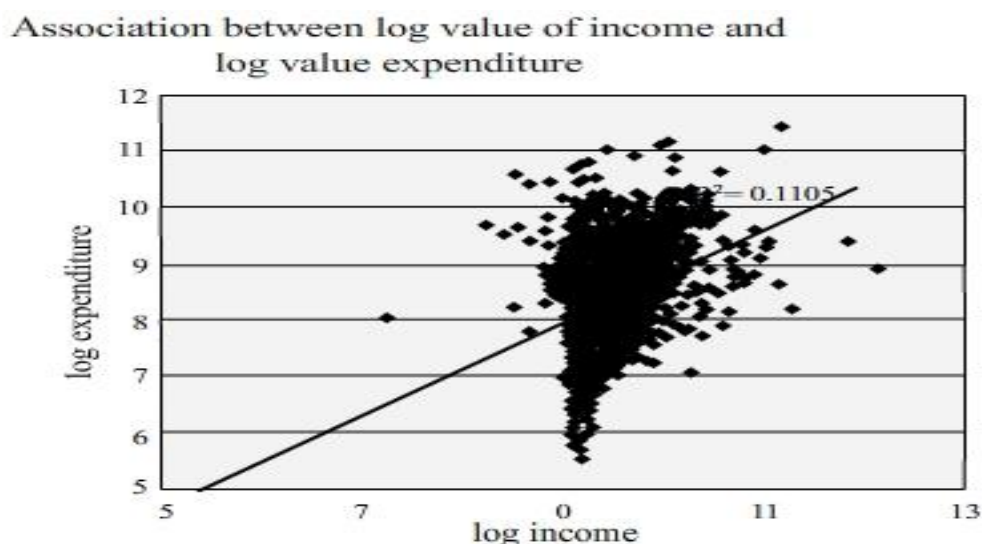
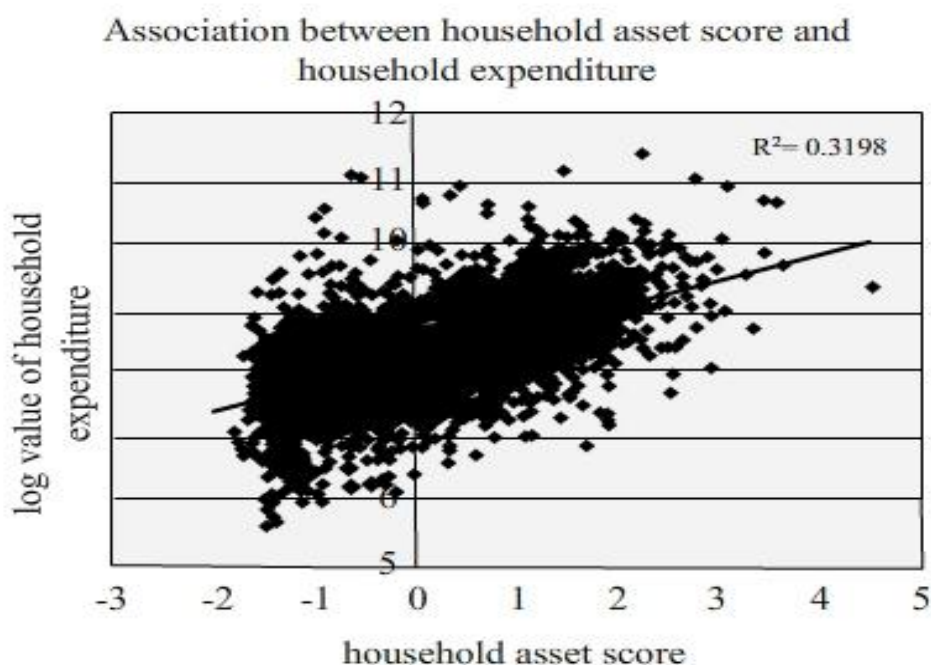


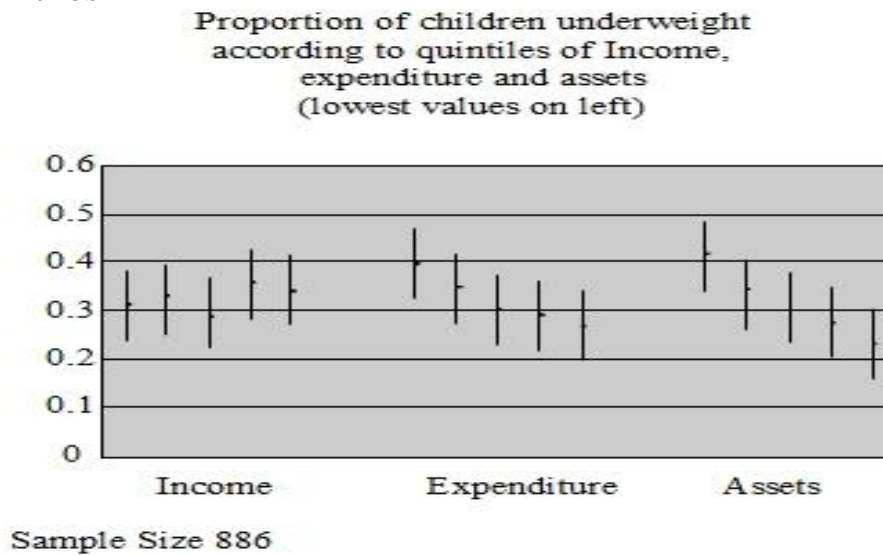
Figure: 5 Associations between Household Asset and Household Income



*Correlation between Measures of Economic Status and Health-Social indicators*

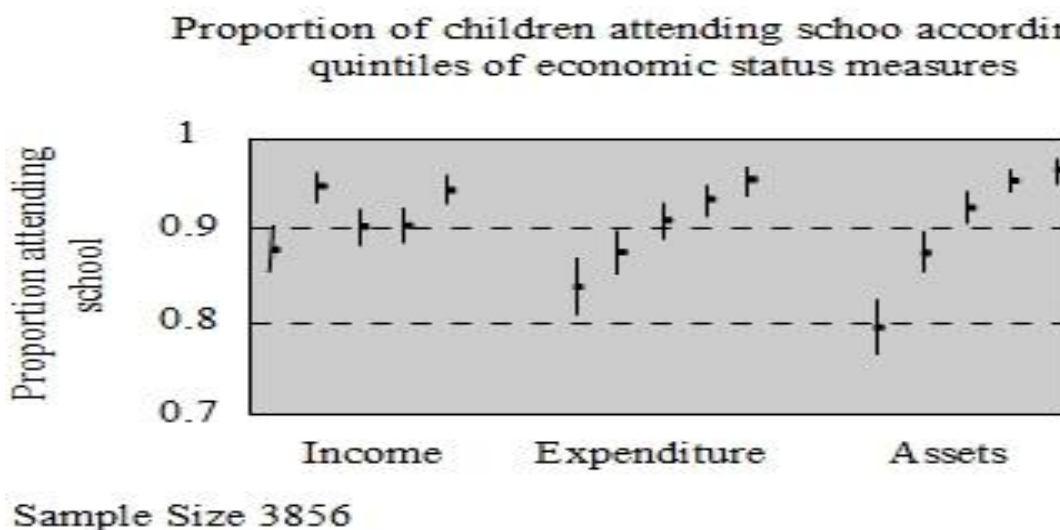
The proportion of children underweight is shown according to quintiles of household income, expenditure and assets in figure 6. There is little correlation between household income and nutritional status but for the other two measures those in the lowest quintiles have the poorest nutritional status. However, the strength of association is greater for assets than for consumption (figure 6).

Figure: 6 Children Nutritional Status regarding Income, Expenditure and Asset Quintiles



The proportion of children attending school according to quintiles of household income, expenditure and assets shown in figure 7 indicates that for each measure of economic status those in the highest quintile have a higher proportion of children in school than those in the lowest quintile. However, the correlation between household income and schooling is inconsistent across the quintiles. Consistent association are found for both expenditure and assets, but as for nutritional status, the strongest association is with household assets (figure 7)

Figure: 7 School Attendance by Children regarding Income, Expenditure and Asset Quintiles



## **Discussion**

This analysis found better correlation between household expenditure and household assets than between household income and household assets.

The measure of extent of inequality in health and social outcome by different economic indicators also indicates the same trend and direction when using assets and expenditure rather than using income. Result, shows that children nutritional status and school enrollment is not significantly correlated with household current income. But, both these outcomes are significantly and consistently correlated with household expenditure and household assets. Again, comparing with income and expenditure, household assets seems to be the best indicator to capture the existing poor-rich gap in child nutritional status and their schooling.

The failure to find association between household income and assets may be because income calculated here is the current level of income for a particular year. Income in a particular year may not reflect the long-term household socio-economic status, because household current income tends to vary from year to year. A wealthier household may gain lower income than their expected level of income in a particular year. This phenomenon also happened in case of MHSS income of 1996. For example in MHSS 1996 data set, there are 110 households who gained negative income for that year. Considering this negative income, these households were treated as poorest one. But on the basis of examining other socio-economic variables, these households cannot be treated as poor. For example, the average land ownership of these 110 households is 98 decimal, which is higher than the average land ownership of the whole sample of 83 decimal of land. The average monthly expenditure of these households is also very high than the average monthly expenditure of the whole sample households. The average monthly expenditure of households having negative income is TK. 6947, whereas it is TK. 4767 for the whole sample.

In this research attempt, the transitory nature of income is also reflected in distributions of various assets among different household categories. The usual pattern of distribution of a particular asset would follow an increasing trend from poorest quintile to richest quintile. But when the SES is measured by household income, it is found that, in case of distribution of all assets, the households of poorest quintile tends to have more assets than the households of second quintile. It happened, because households having negative income are classified as poor, who are not truly poor. Thus identifying SES by current income may led to misclassification of household status. In contrast to this, when the

economic status has been measured by household consumption expenditure, the distribution of assets among different quintiles has followed the usual trend.

Comparing with transitory nature of income, assets are the long-term allocation of household resources. While income represents a flow of resources over some period of time, wealth captures the stock of assets at a given points of time, and thus the economic reserves (John and MacArthur 2002). Thus income of a particular year may not be well related with the long-term assets available to the household. Falkingham and Namazie (2002) also mentioned asset indices as weak proxies for current income.

Household consumption expenditure tends to be well correlated with long-term stock of household assets because people do not always expend on the basis of current household income but also on the basis of expected long-term income and of previous accumulation of income and resources. Schenk (1997-98) explained that people base consumption on what they consider their “normal” income. In doing this, they attempt to maintain a fairly constant standard of living even through their incomes may vary considerably from month to month or from year to year. As a result, increase and decrease in income that people see as temporary have little effect on their consumption spending. In other word consumption depends on what people expect to earn over a considerable period of time this is long-term income.

Households’ assets are the indicators of long-term income and thus people base their consumption on households’ available assets. MacArthur (2002) explained wealth as a source of economic security providing an index of a households’ ability to meet emergencies or absorb economic shocks.

## **Conclusion**

Household assets correlated better with health and social outcomes than with household expenditure or household current income. Assets can be good proxies for household expenditure rather than for income. If studies on inequality are considered, assets may be proxies for economic status, since household assets are found to be able to capture existing inequality in health and social indicators. Again, the study suggest that, through household current income was found to led misclassification of household long-term economic status, this could be a better indicator to measure economic shock facing by the household.

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### References

- Bollen. K. J. Glanville and G. Steeklow, (2002). Economic status proxies in studies of fertility in developing countries: does the measure matter? *Population studies*, Vol. 56: 81-96.
- Falkingham, Jane and Ceema Namazie, (2002). *Measuring health and poverty: a review of approaches to identifying the poor*. DFID Health System Resource Centre , London.
- Filmer. D. and L.Z. Pritchett, (2001). 'Estimating wealth effects without income or expenditure data-or tears: an application to educational enrollments in states of India *Demography*. Volume 38-Number 1, February: 115-132.
- Gwatkin, Davidson R, Shea Rutstein, Kiersten Johnson, Rohini P. Pande, and Adam Wagstaff, (2000). *Socio-Economic Differences in Health, Nutrition, and Population*. HNP, The World Bank.
- Houweling, Tanja AJ, Anton E Kunst and Johan P. Mackenbach, (2003). Measuring health inequality among children in developing countries: does the choice of the indicator of economic status matter? *International Journal for Equity in Health*. October: 1-12.
- Kington. R.S. and J.P. Smith, (1997) 'Socioeconomic status and racial and ethnic differences in functional status associated with chronic diseases'. *American Journal of Public Health*, 87: 805-810.
- Montgomery, Mark R., Michele Gragnolati, Kathleen A Burke and Edmundo Paredes, (2000). 'Measuring living standards with proxy variables'. *Demography*. Volume 37-Number 2, May: 155-174.
- Morris, Saul., Calogero Carletto, Jhon Hoddinott, and Lue J. M. Christiaensen (1999). 'Validity of rapid estimates of household wealth and income for health surveys in rural Africa' FCND Discussion paper, IFPRI.
- Rahman., Hossain Zillur (1995). "Rethinking the poverty debate" in Rahman, Hossain Zillur and, Mahabub Hossain (edt). *Rethinking rural poverty: Bangladesh as a case study*. The University Press Limited.
- Sahn, D. and Stifel, (2001). 'Exploring alternative measures of welfare in the absence of expenditure data' mimeo paper. Cornell University.
- Schenk, Robert (1997-98), *Permanent Income Hypothesis*, <http://inbgrimavne.saintjoe.edu/econ/FiscalDead/Permlneome.html>
- Setel, Philip., Savitri Abeyasekera, Patrick Ward, Yusuf Hemed, David Whiting, Robert Mswia, and, Manos Antoninis 'Development, validation, and performance of rapid consumption expenditure proxy for measuring income poverty in Tanzania: experience from AMMP Demographic Surveillance Sites' Project paper for AMMP of Tanzania.
- Stevens, J (1986). *Applied multivariate statistics for the social sciences*. Hillsdale. NJ. Lawrence Erlbaum Associates.
- Wagstaff, Adam and Naoko Watanabe. (2002). What is difference does the choice of SES make in health inequality measurement? Working paper, The World Bank.