Inflation for the Poor in Bangladesh: A Comparison of CPI and Household Survey Data[1]

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In most countries, the consumer price index (CPI) is used to measure inflation and is typically based on national-level price data reflecting purchasing patterns of the average consumer. Adjusting for inflation allows one to compare consumption levels over time in real values. In principle, the same information can be provided by changing the values of "cost-of-basic-needs" (CBN) poverty lines. Poverty lines should ideally reflect the minimum cost of meeting some fixed measure of basic needs or some fixed level of utility. Currently, in Bangladesh, a substantial divergence exists between inflation, as measured by the CPI, and the increasing cost of minimum needs, as measured by changes in national poverty lines over time. It is not clear, a priori, which measure of changing costs is better suited for the purposes of the analyses undertaken in the assessment of poverty. This paper uses the Household Income and Expenditure Survey (HIES), a nationally representative household survey, to assess which of the two measures is more informative in the case of Bangladesh. Our survey-based evidence indicates that the changing costs of living, as experienced by the average Bangladeshi, are better proxied by the changes in poverty lines.

Keywords: Poverty, Poverty Measurement, Inflation, Bangladesh
JEL Codes: I3, I32, E31

I. INTRODUCTION

While poverty lines are not the only element necessary to quantify poverty, they are fundamental to the generation of a country's poverty profile. According

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to Ravallion (1998), "A poverty line helps focus the attention of governments and civil society on the living conditions of the poor." The Bangladesh Bureau of Statistics (BBS) published the official 2010 poverty estimates for Bangladesh, which are based on the Cost of Basic Needs (CBN) methodology and are derived by adjusting existing poverty lines to reflect changes in the cost of meeting basic needs, as indicated by the Household Income and Expenditure Survey (HIES) 2010 data. [2] More specifically, the adjustments to poverty lines for 2010 were obtained by: (i) updating 2005 food poverty lines with food inflation rates calculated from unit values of HIES 2005 and HIES 2010 data; and (ii) re-estimating the non-food poverty line using HIES 2010 data to adjust for the non-food allowance.[3]

While in most countries the consumer price index (CPI) is used to measure inflation, usually at the national-level for the typical consumer, given that poverty lines are often used to measure the real cost of *basic needs* over time they may also provide indirect information about price changes (in addition to measuring and tracking poverty over time). Ideally, poverty lines should reflect the cost of meeting some fixed measure of basic needs (or, reflect the minimum monetary cost of obtaining some fixed level of utility). Therefore, the percentage increase in poverty lines over time can serve as a useful measure of inflation experienced by the poor.

Currently, in Bangladesh, a substantial divergence exists between inflation, as measured by the CPI, and the increasing cost of minimum needs, as measured by changes in national poverty lines over time, referred hitherto as the Basic Need Price Index, or BNPI (see Tables I to III). Figure 1 illustrates this divergence. In particular, the figure presents poverty headcount trends under poverty lines that use alternative price adjustments. The four alternatives displayed include: the official poverty headcount, which is based on the national poverty line estimated using the Cost of Basic Need method (solid line); the World Bank $1.25 poverty line, which adjusts the 2005 purchasing power parity (PPP) exchange rate using the CPI (dashed line); the World Bank $1.25 poverty line, which adjusts the 2005 PPP exchange rate using inflation as implied by the BNPI (long dashed line); and lastly, the poverty headcount implied by the 2005 population-weighted (or national) poverty line projected for 2000 and 2010 using the CPI (dotted line).

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[2]The CBN methodology is explained in more detail in Section II.
[3]See Appendix I in the BBS and World Bank (2012) report for a detailed description of the methodology used to update poverty lines.

TABLE I
ALTERNATIVE MEASURES OF NATIONAL INFLATION

Index (Base 2000)	National		
	2000	2005	2010
General-CPI (Base Year: 2000/01=100)	100	126	184
General-Upper poverty line (Pop. Weighted)	100	126	234
General-Upper poverty line (Rural Dhaka)	100	129	230
Food-CPI (Base Year: 2000/01=100)	100	127	196
Food-Upper poverty line (Pop. Weighted)	100	125	224
Food-Upper poverty line (Rural Dhaka)	100	129	219
Non-Food-CPI (Base Year: 2000/01=100)	100	126	167
Non-Food-Upper poverty line (Pop. Weighted)	100	127	252
Non-Food-Upper poverty line (Rural Dhaka)	100	130	252

CPI = Consumer Price Index; U(L)poverty line = Upper (Lower) Poverty Line.
Source: BBS, HIES 2000, 2005, and 2010.

TABLE II

ALTERNATIVE MEASURES OF INFLATION BY AREA

Index (Base 2000)	Urban			Rural		
	2000	2005	2010	2000	2005	2010
General-CPI (Base Year: 2000/01=100)	100	125	180	100	124	182
General-Upper poverty line (Pop. Weighted)	100	118	221	100	127	232
General-Upper poverty line (Rural Dhaka)	100	129	230	100	129	230
Food-CPI (Base Year: 2000/01=100)	100	127	201	100	125	192
Food-Upper poverty line (Pop. Weighted)	100	118	213	100	127	224
Food-Upper poverty line (Rural Dhaka)	100	129	219	100	129	219
Non-Food-CPI (Base Year: 2000/01=100)	100	124	159	100	123	164
Non-Food-Upper poverty line (Pop. Weighted)	100	118	235	100	126	247
Non-Food-Upper poverty line (Rural Dhaka)	100	130	252	100	130	252

CPI = Consumer Price Index; U(L)poverty line = Upper (Lower) Poverty Line.
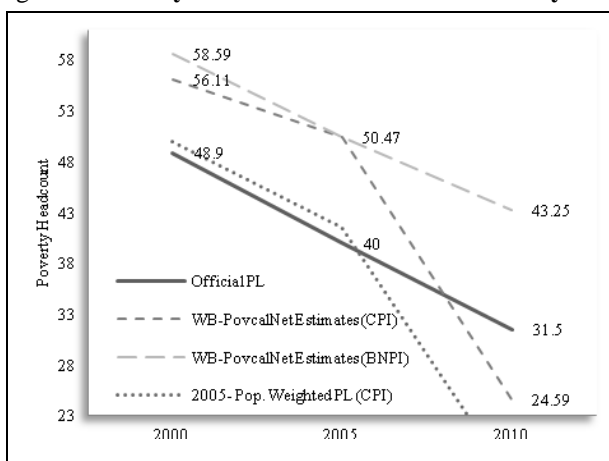**Source:** BBS, HIES 2000, 2005, and 2010.

TABLE III
**NOMINAL AND PER-CAPITA CONSUMPTION USING
ALTERNATIVE MEASURES OF INFLATION**

Consumption	2000	2005	2010	% △00-05	% △05-10	% △00-10
Nominal per-capita	877	1231	2447	40	99	179
Real per-capita (CPI)	877	990	1350	13	36	54
Real per-capita (Upper poverty line-Rural Dhaka)	877	951	1064	8	12	21
Real per-capita (Upper poverty line-Stratum)	877	991	1067	13	8	22
Real per-capita (Upper poverty line-Pop. weighted)	877	978	1047	12	7	19

CPI = Consumer Price Index; Upper poverty line = Upper (Lower) Poverty Line.
Source: BBS, HIES 2000, 2005, and 2010.

Figure 1: **Poverty Headcount - Alternative Poverty Lines**

Source: HIES 2000, 2005, and 2010.

While consumption patterns for the poor likely differ from typical, non-poor consumption patterns, the difference in consumption is generally less pronounced in a country with high poverty rates. This large divergence between the inflation implied by the CPI and inflation implied by the BNPI suggests that the former is not capturing inflation as experienced by the poor. On the one hand, the CPI in Bangladesh is constructed using a standard Laspeyres-type based-weighted price index. The CPI informs us about how the cost of the base-year bundle changed over time, but it does not take into account potential substitution effects (i.e.

consumer substitution in response to price changes). On the other hand, poverty line-based inflation allows the underlying *basic needs* consumer bundle to change over time while the consumer maintains a fixed level of utility. The latter is conceptually closer to the cost of living index (COLI), which reflects changes in all factors beyond the direct consumption of goods and services that affect consumer welfare (Diewert, Greenleess, and Hulten 2009).

A large divergence between the CPI, the official inflation measure of Bangladesh, and the rate of change in the poverty lines is problematic for Bangladesh, a relatively high poverty country. This divergence suggests both that the CPI is not capturing inflation as experienced by the poor and that the CPI is not a good measure of price changes (at least not for the majority). Furthermore, this divergence has significant implications for the measurement of the real value of all money-metrics (see, for example, the case of consumption expenditure presented in Table III).

The aim of this study is to use the Household Income and Expenditure Survey (HIES), a nationally representative household survey, to determine which of the two inflation measures is more appropriate in the case of Bangladesh. First, we provide a brief recount of how inflation is measured in Bangladesh as well as the construction/re-estimation of poverty lines over the last decade. Next, using a HIES-based price index, we scrutinize both the temporal and spatial dimensions of price changes, as measured by the CPI and the BNPI. We conclude the study by summarizing our main findings and conclusions.

II. MEASURING INFLATION IN BANGLADESH

In Bangladesh, the official measure of inflation is the Consumer Price Index (CPI), which is calculated using a Laspeyres "based-weighted" price index.[4] The weights, which are shares of goods in the initial expenditure basket, are periodically updated using the Household Income and Expenditure Surveys (HIES).[5] Currently, these weights correspond to commodity-wise expenditure shares from the 1995/96 HIES.[6] The national CPI is a weighted-average of rural and urban CPIs, with weights of 70.9 percent and 29.1 percent, respectively.

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[4]This sections draws heavily from the BB (2008) report.

[5]Before, the weights used in estimating the CPI corresponded to commodity-wise expenditures shares from the 1985/86, 1973/74, and 1969/70 Household Expenditure Survey - HES (see section 2 of the BB 2008 report).

[6] At the time of the writing of this manuscript, the CPI weights were revised using the HIES 2005.

Similarly, the general CPI in each region is the weighted-average of the food and non-food CPIs; the weights are the respective expenditure shares of food and non-food items, as estimated from the HIES. The CPI cannot be disaggregated into more specific geographical areas (i.e. divisions or strata). To account for regional differences in expenditures, the urban and rural CPIs differ in the number of goods included in their respective expenditure baskets. The expenditure basket that corresponds to rural (urban) areas is composed of 215 (302) items. The CPI can be used as a measure of national/urban/rural inflation but cannot be used to adjust for spatial price differences across strata[7] (i.e. the CPI is not a spatial price index, as is the case with most CPIs across the world).

2.1 Poverty Lines in Bangladesh

As suggested by Ravallion (2001), Bangladesh's Poverty lines are periodically updated using a price index (as done for both food and non-food Poverty lines in 1995/96 and 2000, and only for the food poverty line in 2010) or re-estimated using the CBN method (as done in 1991/92 and 2005).[8] The expectation is that both of these methods (price index or CBN) maintain a constant level of wellbeing in real terms and, thus, provide a good measure of poverty and price changes over time.

Under the first method, the food basket quantities are fixed but market prices are updated using an appropriate price index. Under the second method, a new food basket is estimated when a new poverty line is recomputed following the CBN method. Using the CBN method, calculation of Poverty lines entails estimation of the average level of per capita expenditure at which individuals can meet basic food and non-food needs. The CBN method is implemented in three steps. In the first step, the cost of a fixed food bundle is determined. In the case of Bangladesh, this bundle consists of eleven food items that include: rice, wheat, pulses, milk, oil, meat, fresh water fish, potato, other vegetables, sugar, and fruits. The bundle provides the minimal nutritional requirements that correspond to 2,122 kcal per day per person. In the second step, two different non-food allowances for non-food consumption are computed: the lower non-food allowance (the median amount spent on non-food items by households whose

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[7] In 2000/01 (2005 and 2010/11), Bangladesh had a total of 14 (16) strata.
[8] For more details related to the construction and updating of the poverty lines for Bangladesh, see: World Bank 2002, pp. 92-95, for the years 1991/92, 1995/96, and 2000, World Bank 2008, p. 111, Box A-1.1 for the year 2005, and BBS (2012), pp. 99-104, for the years 2010/11.

total consumption is approximately equal to their food-poverty line)[9] and the upper non-food allowance (the amount spent on non-food items by households whose food consumption is approximately equal to their food-poverty line). In the third step, the food and non-food allowances are added together. The sum of the food and upper non-food allowances constitute the upper poverty line.[10,11]

Both methods have limitations in terms of maintaining a constant measure of wellbeing in real terms. The first method, which maintains the same bundle of goods, will not reflect the fact that, as relative prices change, individuals will likely substitute relatively more expensive goods with the relatively cheaper ones. A constant bundle of goods, when relative prices are changing, is unlikely to maintain the same utility level. But, a similar critique can be made of the BNPI. When basic needs are re-estimated, the bundle of goods can completely change. If everyone has become better off over time, the average cost per calorie (based on the "relatively" poor) is likely to increase even if prices of goods are unchanged because the bundle of goods being consumed reflects improved wellbeing. In short, the changing bundle may now reflect a higher-level of wellbeing.

To address these concerns about making appropriate poverty comparisons over time, Lanjouw and Lanjouw (2001) propose using the CBN method. The authors show that re-estimation of Poverty lines based on the CBN method can produce comparable poverty lines in real terms when the following set of assumptions hold: (1) the consumption measures are monotonically increasing in total expenditures (akin to Engel's Law); (2) relative prices, which determine consumption patterns, are stable across time and the groups under comparison; and (3) no measurement error exists in the expenditure data. The authors demonstrate that the CBN method allows for measuring poverty and price changes over time without having to rely on the existence of a price index. Nevertheless, like the first method, this method also assumes that relative prices and tastes remain unchanged.

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[9]The rationale behind this calculation is that the non-food budgets of these households are set to just afford the   bare essentials.

[10]In 2000/01 (2005 and 2010/11), a total of 14 (16) Poverty lines existed, each corresponding to one of Bangladesh's 14 (16) strata.

[11]The "upper poverty line" ("lower poverty line") is the reference level of per capita consumption expenditures used to estimate the national poverty (extreme poverty) headcount, also known as the moderate poverty (severe poverty) rate.

Bangladesh's Poverty lines by year and stratum are presented in Tables IV-V. In the next paragraphs, we provide a brief recount of the construction/re-estimation of Bangladesh's Poverty lines over the last decade.

TABLE IV

POVERTY LINES

Region	Lower poverty line	Upper poverty line	FOOD	NON-FOOD	Lower poverty line	Upper poverty line	FOOD	NON-FOOD
	1995/96				*2000*			
Rural Barisal Pathuakali	413	467	360	107	494	558	428	128
Rural Noakhali Chittagong	438	541	395	146	522	645	470	174
Other Urban Chittagong	517	609	408	201	619	730	490	241
SMA Chittagong	523	722	448	274	627	867	537	329
Rural Dhaka	425	512	379	133	492	593	440	154
Other Urban Dhaka	399	482	328	154	480	580	393	185
SMA Dhaka	480	660	389	271	574	791	467	325
Rural Khulna Jessore Kushtia	420	497	363	134	499	592	432	160
Urban Khulna	482	635	425	210	552	727	485	239
Rural Rajshahi Pabna	459	540	394	146	535	630	461	171
Urban Rajshahi	446	582	390	192	496	647	433	213
Rural Sylhet Comilla	432	558	430	128	499	644	494	148
Rural Faridpur Tangail Jamalpur	432	472	373	99	484	529	418	111
Rural BograRa Dajpur	426	487	365	122	468	535	402	134

(Contd. Table IV)

Region	Lower poverty line	Upper poverty line	FOOD	NON-FOOD	Lower poverty line	Upper poverty line	FOOD	NON-FOOD
	2005				*2010*			
Barisal (Rural)	753	926	583	343	1284	1485	982	503
Barisal (Muni.)	800	951	599	352	1419	1963	1100	863
Chittagong (Rural)	753	891	568	323	1404	1687	1023	664
Chittagong (Muni.)	749	963	561	402	1495	1825	1064	762
Chittagong (SMA)	766	1171	578	593	1479	1876	1047	829
Dhaka (Rural)	728	842	565	277	1276	1497	958	538
Dhaka (Muni.)	749	890	579	311	1314	1793	1018	775
Dhaka (SMA)	806	1018	601	417	1406	2038	1089	948
Khulna (Rural)	652	743	510	233	1192	1435	884	551
Khulna (Muni.)	670	825	517	308	1262	1680	932	748
Khulna (SMA)	706	938	552	386	1348	1639	970	669
Rajshahi (Rural)	656	766	509	257	1236	1487	957	529
Rajshahi (Muni.)	696	857	530	327	1312	1585	987	598
Rajshahi (SMA)	722	856	523	333	1223	1556	931	625
Sylhet (Rural)	697	822	549	273	1240	1311	953	358
Sylhet (Muni.)	806	1020	549	471	1286	1558	992	566

Source: World Bank 2002 and 2008, BBS and World Bank 2012.

TABLE V
HARMONIZED POVERTY LINES 2000, 2005, AND 2010

Region	2000		2005		2010	
	Lower poverty line	Upper poverty line	Lower poverty line	Upper poverty line	Lower poverty line	Upper poverty line
Barisal (Rural)	580	714	753	926	1284	1485
Barisal (Muni.)	643	764	800	951	1419	1963
Chittagong (Rural)	619	733	753	891	1404	1687
Chittagong (Muni.)	643	827	749	963	1495	1825
Chittagong (SMA)	639	978	766	1171	1479	1876
Dhaka (Rural)	563	651	728	842	1276	1497
Dhaka (Muni.)	625	742	749	890	1314	1793
Dhaka (SMA)	678	855	806	1018	1406	2038
Khulna (Rural)	511	582	652	743	1192	1435
Khulna (Muni.)	561	690	670	825	1262	1680
Khulna (SMA)	582	773	706	938	1348	1639
Rajshahi (Rural)	511	598	656	766	1236	1487
Rajshahi (Muni.)	575	707	696	857	1312	1585
Rajshahi (SMA)	576	682	722	856	1223	1556
Sylhet (Rural)	560	661	697	822	1240	1311
Sylhet (Muni.)	666	843	806	1020	1286	1558

Source: World Bank 2008, BBS and World Bank 2012.

2.2 Bangladesh Poverty Assessment 2000

Poverty lines were first estimated in 1991/92 (the base year) and subsequently updated in 1995/96 and 2000 to account for price changes (see Table IV). In 2001, different Poverty lines were estimated for Bangladesh's 14 different geographical areas (nine urban and five rural areas). To update the base-year Poverty lines to 2000, price indices were derived by combining price information obtained from HIES (corresponding to food and non-food items that account for approximately two-thirds of total household expenditure) and the non-food CPI; the price indices are reported in Table VI.[12]

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[12]For more details on the poverty lines update for the year 2000, Please refer to the Technical Appendix of the World Bank (2002) report, pp. 92-96.

TABLE VI

PRICE INDICES

Region	Food HIES Index	Covered budget sh.	Non-Food CPI	Composite Price Index	Food HIES Index	Covered budget sh. (%)	Non-Food CPI	Composite Price Index
		1991/92 - 1995/96				1995/96-2000		
SMA Dhaka	1.20	59%	1.20	1.20	1.10	53	1.16	1.13
Other Urban Dhaka	1.20	68%	1.20	1.20	1.03	60	1.16	1.08
Rural Dhaka	1.12	74%	1.26	1.16	1.07	72	1.20	1.11
Rural Faridpur Tangail Jamalpur	1.08	79%	1.26	1.12	1.07	74	1.20	1.12
SMA Chittagong	1.20	62%	1.20	1.20	1.09	59	1.16	1.12
Other Urban Chittagong	1.20	67%	1.20	1.20	1.09	60	1.16	1.12
Rural Sylhet Comnilla	1.12	77%	1.26	1.15	1.11	71	1.20	1.15
Rural Noakhali Chittagong	1.17	73%	1.26	1.19	1.06	67	1.20	1.11
Urban Khulna	1.12	67%	1.20	1.14	1.06	62	1.16	1.10
Rural Barishal Pathuakali	1.17	77%	1.26	1.19	1.05	70	1.20	1.10
Rural Khulna Jessore Kushtia	1.16	73%	1.26	1.19	0.98	69	1.20	1.05
Urban Rajshahi	1.07	67%	1.20	1.11	1.08	61	1.16	1.12
Rural Rajshahi Pabna	1.13	73%	1.26	1.17	1.04	71	1.20	1.10
Rural BograRa Dajpur	1.04	75%	1.25	1.10	1.01	70	1.20	1.09
		2000 – 2005				2005-2010		
Barisal (Rural)	1.31	48%	1.28	1.30	1.69	66	1.33	1.55
Barisal (Muni.)	1.28	51%	1.24	1.24	1.8/4	56	1.29	1.59
Chittagong (Rural)	1.17	52%	1.28	1.22	1.80	61	1.33	1.60
Chittagong (Muni.)	1.13	50%	1.24	1.16	1.89	58	1.29	1.60
Chittagong (SMA)	1.19	41%	1.24	1.20	1.81	56	1.29	1.53
Dhaka (Rural)	1.31	52%	1.28	1.29	1.70	64	1.33	1.55
Dhaka (Muni.)	1.20	54%	1.24	1.20	1.76	57	1.29	1.54
Dhaka (SMA)	1.18	50%	1.24	1.19	1.81	53	1.29	1.55
Khulna (Rural)	1.28	54%	1.28	1.28	1.73	62	1.33	1.57
Khulna (Muni.)	1.19	52%	1.24	1.20	1.80	55	1.29	1.56
Khulna (SMA)	1.22	49%	1.24	1.21	1.76	59	1.29	1.55
Rajshahi (Rural)	1.29	52%	1.28	1.28	1.88	64	1.33	1.66
Rajshahi (Muni.)	1.22	51%	1.24	1.21	1.86	62	1.29	1.60
Rajshahi (SMA)	1.30	49%	1.24	1.25	1.78	60	1.29	1.54
Sylhet (Rural)	1.23	54%	1.28	1.24	1.74	73	1.33	1.59
Sylhet (Muni.)	1.22	45%	1.24	1.21	1.81	64	1.29	1.56

Source: World Bank 2002 and 2008, BBS and World Bank 2012.

2.3 Bangladesh Poverty Assessment 2005

In 2005, Poverty lines were updated using the HIES 2005 data and following the same CBN method described above. This time, sixteen stratum-specific Poverty lines were estimated for Bangladesh (ten urban and six rural areas). To ensure comparability across years, the estimated Poverty lines were back-casted to 2000 using price indices that combine price information available in the HIES (prices corresponding to food items that account for more than one-half of total household expenditure) and the non-food CPI (see Table V).

After examining the data and comparing alternative methods, the technical committee for poverty estimation, which consisted of researchers and experts on poverty measurement in Bangladesh, recommended an approach which uses parts of both methods described above (i.e. updating and re-estimation) to update the 2005 Poverty lines. In particular, while food Poverty lines for 2010/11 were updated from 2005 using stratum-specific, Törnqvist price indices, the upper and lower non-food Poverty lines were re-estimated using the CBN approach (the same procedure used to estimate 2005 non-food Poverty lines) with the HIES 2010/11 data. The primary motivation for this choice is the concern that the non-food CPI may not faithfully reflect inflation faced by the poor. Although the technical committee acknowledges that the CPI is widely used to convert nominal values into real values in national accounts, the committee maintains that the CPI is not a good inflation measure for poverty analysis.

As in 2005, sixteen stratum-specific Poverty lines were estimated for Bangladesh in 2010 (ten urban and six rural). To update 2005 (base-year) food Poverty lines to 2010, price indices used price information obtained from HIES (which contains prices corresponding to *food* items that account for more than 60 percent of total household expenditure). The non-food allowance was re-calculated following steps 2 and 3 of the CBN method described above and used the HIES 2010 data.

III. TEMPORAL PRICE CHANGES: SURVEY-BASED EVIDENCE

"An absolute approach in the space of capabilities translates into a relative approach in the space of commodities" (Sen 1983, p. 168)

3.1 Demographic Change Over Time

When Poverty lines are estimated following the CBN method, at least two forces are likely to change the real values of Poverty lines: *economic growth* and *demographic changes* (Ravallion 1998). In other words, as a country becomes wealthier and as fertility declines, a real increase in the cost of the minimum needs required to fully participate in society is likely. In particular, as Ravallion

(1998) explains, when average income increases and fertility falls, consumption shifts away from food (food represents a smaller share of the consumption bundle, so its relative price rises). Then, under the assumption that food and non-food are uncompensated substitutes, a decrease in the relative price of non-food leads to an increase in the poverty line. In other words, due to the income effect, individuals will adjust their consumption bundles in order to maintain an equivalent level of utility, an adjustment which results in higher, real-valued Poverty lines.

This section explores whether or not the effect of Bangladesh's demographic changes over the 2005-2010 period is significant. If significant, this effect can help to parse out one of the causes of the divergence between the CPI and Poverty lines. To make this assessment, we investigate whether the demographic changes that took place help to predict the observed changes in both poverty headcount rates and per-capita consumption for the period between 2005 and 2010. In particular, we pool the 2005 and 2010 HIES data at the household-level and generate eight age-gender cohort variables, measuring the number of household members falling into each cohort.[13] Then, using this pooled sample,[14] we regress the poverty headcount rate (as implied by the official upper Poverty lines for 2005 and 2010) and per-capita consumption on the eight age-gender cohorts, a time trend (which equals one if the survey year is 2010), and 15 dummies for each stratum (Barisal is the base group).

The estimated coefficients from these regressions are presented in Table VII. First, we obtain separate means for each age-gender cohort for survey years 2005 and 2010. Using these year- and cohort-specific means, we compute the average change in household composition by age-gender cohort for the 2005-2010 period by subtracting each 2005 age-gender cohort mean from the 2010 age-gender cohort mean. Then, we multiply the estimated means by the average change in household composition calculated for each age-gender cohort. Summing up these products over each age-gender cohort suggests that approximately one-third of the overall poverty reduction is associated with changes in household composition. In particular, we observe that, while the number of adults and children declined over time, the decline in the number of adults increased the likelihood of being poor, whereas the reduced number of children decreased the likelihood of being poor (not surprisingly, since adults are more likely than

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[13]The relevant age-gender-cohorts are: Men (+55), Women (+55), Men (26-55), Women (26-55), Men (18-25), Women (18-25), Boys (10-17), Girls (10-17), Boys (6-9), Girls (6-9), Boys (0-5), and Girls (0-5).

[14]We chose to pool the samples to increase efficiency. To deal with the sampling weights, household weights are scaled by a factor of ½.

children to contribute to household income). Furthermore, the estimates hint at a decline in fertility as the most important demographic change contributing to the reduced likelihood of being poor (the contribution of demographic changes to household composition increases to 40% if considering only the decline in the number of children per household). Overall, the results suggest that households are smaller in size, primarily due to a reduction in fertility, in 2010 relative to 2005.

TABLE VII

PREDICTED CHANGE IN POVERTY DUE TO CHANGES IN HOUSEHOLD (HH) COMPOSITION

Change in poverty		Total	HH-Comp. Children (All)	Trend
		-0.0849	39.7% (32.99%)	64.75%
		Return-Poverty Headcount	Change in HH-Comp.	Coefficient
Constant				0.4376
Time Trend		-0.0549	1.0000	-0.0549
Men (+55)		0.0006	-0.0154	-0.0382
Women (+55)		-0.0002	0.0055	-0.0371
Men (26-55)		0.0034	-0.0468	-0.0735
Women (26-55)		0.0012	-0.0155	-0.0793
Men (18-25)		0.0005	-0.0473	-0.0116
Women (18-25)		0.0001	-0.0051	-0.0204
Boys (10-17)		-0.0026	-0.0817	0.0318
Girls (10-17)		-0.0027	-0.0735	0.0370
Boys (6-9)		-0.0029	-0.0223	0.1279
Girls (6-9)		-0.0020	-0.0184	0.1095
Boys (0-5)		-0.0103	-0.0685	0.1497
Girls (0-5)		-0.0132	-0.0892	0.1485
Change in HH Comp.	**Abs. change**	**Out of total change**	**Resulting change in poverty**	**Out of total change**
Total change	-0.478	100%	-2.80%	-100%
Change in male members	-0.282	59%	-1.11%	-40%
Change in female members	-0.196	41%	-1.69%	-60%
Change in male adults	-0.110	23%	0.46%	16%
Change in female adults	-0.015	3%	0.11%	4%
Change in male children	-0.173	36%	-1.57%	-56%
Change in female children	-0.181	38%	-1.80%	-64%

Source: Authors' own calculations using HIES 2005 and 2010.

Next, following the same procedure described in the previous paragraph, we predict changes in per capita consumption. The results from this exercise (Table VIII) show that the average change in household composition led to an increase in per capita consumption of approximately Tk 72.1. If we only consider changes in the number of children, per capita consumption increases to Tk 79.4. Re-estimating the poverty headcount rate after reducing the poverty line by Tk 72 (80), we observe that the official poverty headcount rate is reduced by 4.31 (4.76) percentage points, which translates into a 14 (15) percent reduction. These numbers are reported in the bottom panel of Table VIII. For comparison, we also reproduce the official poverty headcount and the poverty headcount estimates under a poverty line constructed by combining the food component of each year with the non-food component of 2005 and adjusted using a survey-based composite price index. The latter estimates are fairly close to the estimates obtained after adjusting official Poverty lines for changes in household composition.

The time trend explains about 93% of the increase in nominal per-capita consumption. As might be expected, this is equivalent to the increase in inflation implied by the BNPI. The results also suggest that the decline in fertility resulted in a real increase in per-capita consumption. Because the income effect is expected to be relatively small for the food component, the evidence presented in this section is consistent with the hypothesis that as fertility declines, consumption shifts away from food which causes the non-food share of consumption to be relatively higher and, consequently, the real value of the poverty line to be higher.[15] The hypothesis, which suggests the reallocation of resources from food to non-food consumption, can partially explain the relatively larger divergence between the non-food CPI and BNPI compared to the divergence between the food CPI and BNPI.

These results provide support for use of the BNPI to measure inflation in the average cost of living by suggesting a theoretically-based and empirically-backed avenue for the CPI to be biased downwards. To recapitulate, the demographic changes experienced by Bangladesh over the last five years, and the attendant change in relative prices, have downward-biased the CPI relative to the BNPI. This is not surprising since the CPI, unlike the BNPI, was never intended for use as a cost-of-living index.

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[15]For a more detailed description of the mechanisms behind this statement, please refer to Ravallion (2001).

TABLE VIII

PREDICTED CHANGE IN PER-CAPITA CONSUMPTION DUE TO CHANGES IN HOUSEHOLD (HH) COMPOSITION

Change in consumption		Total	HH-Comp. Children (All)	Trend
		1217	6.53% (5.93%)	92.51%
		Return- Per-capita Consumption	Change in HH-Comp.	Coefficient
Constant		1165.83		1165.83
Time Trend		1125.60	1.0000	1125.60
Men (+55)		-2.51	-0.0154	162.59
Women (+55)		0.62	0.0055	111.74
Men (26-55)		-5.03	-0.0468	107.58
Women (26-55)		-3.33	-0.0155	215.33
Men (18-25)		2.99	-0.0473	-63.25
Women (18-25)		-0.03	-0.0051	6.13
Boys (10-17)		11.97	-0.0817	-146.56
Girls (10-17)		5.86	-0.0735	-79.67
Boys (6-9)		6.28	-0.0223	-281.20
Girls (6-9)		5.20	-0.0184	-282.42
Boys (0-5)		21.28	-0.0685	-310.81
Girls (0-5)		28.79	-0.0892	-322.60
Change in HH Comp.	Abs. change	Out of total change	Resulting change in poverty	Out of total change
Total change	-0.478	100%	72.10	100%
Change in male members	-0.282	59%	34.99	49%
Change in female members	-0.196	41%	37.11	51%
Change in male adults	-0.110	23%	-4.55	-6%
Change in female adults	-0.015	3%	-2.75	-4%
Change in male children	-0.173	36%	39.54	55%
Change in female children	-0.181	38%	39.85	55%
Estimated Poverty Headcount				
Year	Actual	2005-NFpoverty line-PC[1]	Consumption 79.4 Tk[2]	Consumption + 72.1 Tk[3]
2000	48.85	48.88	48.85	48.85
2005	39.99	40.00	40.00	40.00
2010	31.51	25.24	26.74	27.19

Source: Authors' own calculations using HIES 2005 and 2010.

Note:[1]This constructed poverty line combines the food component of each year with the non-food component of 2005, adjusted using the survey-based price index. [2] This is the estimated average increase in consumption due to changes in the number of children (less than 18 years of age). [3] This is the estimated average increase in consumption due to changes in household demographics (includes children and adults).

3.2 Price Changes Over Time

The HIES data allow for partial testing of whether or not price changes, as observed in the data, match inflation measured using the CPI. In particular, the 2005 and 2010 HIES data contain enough information that allows for the construction of an aggregate price index consisting of food, clothing, footwear, and rent (categories which account for about 70 percent of total consumption).

The index of rent prices is based on the hedonic model of housing prices,[16] as used in constructing the measure of total consumption. In this model, the available information on rental prices and housing characteristics is used to predict the cost of housing for the whole sample for each survey year.[17] First, the log of annual rental payments in 2005 is regressed on household characteristics in 2005, and the analogous regression is run for the 2010/11 data. Then, using the estimated parameters from 2010/11 and housing characteristics in 2005, one can estimate the rental value of the 2005 characteristics based on 2010 prices (parameters). Comparison of the rental cost of the 2005 characteristics in 2005 with the cost of these same characteristics in 2010 provides an estimate for rental inflation. The results are presented in Table IX. The implied national, rural, and urban inflation rates for housing costs are 46 percent, 43 percent, and 54 percent, respectively; the analogous rates using the CPI are 33 percent, 38 percent, and 20 percent, respectively. Assuming the data collected for the HIES, a nationally representative survey, provides a better representation of the overall population than the CPI data, the CPI, then, grossly underestimates the rental inflation rate in urban areas, though it provides a decent approximation of the rental inflation rate in rural areas.

TABLE IX
TEMPORAL PRICE CHANGES 2005-2010

	Footwear & Garment	Housing	Non-food	Food	Overall (excluding "Other")
National	53.43%	45.81%	51.37%	78.46%	71.10%
Rural	70.90%	42.78%	45.79%	77.39%	69.32%
Urban	47.20%	54.29%	67.01%	81.46%	76.08%

Source: Authors' own calculations using HIES 2005 and 2010.

The HIES also allows for the construction of a footwear and garment price index. In particular, we calculate the per-unit cost of two footwear items and thirteen readymade garments, as well as the two categories' respective budget shares, for each household.[18] Then, stratum-level mean budget shares for the base

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[16]While it would be ideal to impute rent values based on a sample selection model, in the absence of a valid exclusion restriction, we have chosen to rely on a hedonic price regression model.

[17]In particular, the log of rental payments is regressed on the log of the number of rooms, log of land size, indicators for the existence of a dining area, a separate kitchen, safe water supply, electricity, a phone line, for whether the wall material is brick, as well as stratum-level fixed effects.

[18]The selection criteria is to include the item as long as at least ten households in each stratum have valid/non-missing entries for both the value paid for the item and the quantity purchased.

year (2005) and stratum-level prices for each of the surveys (2005 and 2010/11) are computed. This information is used to compute a Laspeyres-type price index for each of the two item groups and for each year. The weighted sum of these indices (their weights correspond to their respective stratum-level expenditure shares) yields a single price index (column 1 of Table IX). The national, rural, and urban inflation rates implied by this index are 53 percent, 71 percent, and 47 percent, respectively; the analogous numbers using the CPI are 28 percent, 25 percent, and 34 percent, respectively. Compared to the price index produced using the HIES data, the CPI underestimates footwear and clothing inflation rates for both urban and rural areas. To obtain a single, non-food price index, we compute the weighted sum of the housing price index and the footwear and clothing price index (their weights correspond to their respective CPI weights). The national, rural, and urban inflation rates implied by this non-food price index are 51 percent, 46 percent, and 67 percent, respectively; the analogous numbers using the CPI are 33 percent, 33 percent, and 28 percent, respectively.

Next, we construct a food price index using thirteen different food categories, with a modal/representative food item selected from each category. The median price of this item is then measured for each stratum. Each item's price is assigned a weight based on the national food share of that category. The national, rural, and urban inflation rates implied by this index are 78 percent, 77 percent, and 81 percent, respectively. The analogous rates using the CPI are 54 percent, 54 percent, and 58 percent, respectively.

Combining the three indexes (food, footwear and garment, and housing) into a single index, with each index weighted according to their CPI weights, we find that the implied national, rural, and urban inflation rates are 71 percent, 69 percent, and 76 percent, respectively. The analogous numbers using the CPI are 46 percent, 47 percent, and 44 percent, respectively.

Survey-based evidence, using the HIES, suggests that the CPI underestimates inflation as faced by the poor in Bangladesh. At the national-level, the CPI-implied inflation rate is 25 percentage points (or 35 percent) lower than the implied survey-based inflation rate; while the poverty line-implied inflation rate is 15 percentage points higher than the survey-based rate. If we take into account the seven percent increase in consumption attributable to changes in household composition, for each of the indices, the gap between the implied survey-based and BNPI-based inflation rates decreases to only seven percentage points (71 percent and 78 percent, respectively). Based on this evidence, we conclude that the BNPI (or poverty line-implied inflation rate), relative to the CPI, is a more accurate measure of inflation for Bangladesh.

Since the CPI is often believed to overstate the inflation in the cost of living because it does not account for the availability of cheaper substitutes, this finding may be counterintuitive. However, that the CPI underestimates inflation is not unique to Bangladesh. Deaton (2008) finds that the Consumer Price Index for Agricultural Labourers (CPIAL, the official national price index for rural India) understates the rate of food price inflation and the nominal poverty line over the five-year period from 1999-2000 to 2004-2005. Using data from India's household expenditure surveys, Deaton (2008) identifies two root causes for his finding: (1) outdated CPIAL weights and (2) weights that are too heavy assigned to food in a period when food prices fell relative to non-food prices. The rule of thumb is to update the CPI weights every ten years, so that significant changes in consumer buying habits or shifts in population distribution or demographic can be taken into account. In Bangladesh, however, these weights correspond to commodity-wise expenditure shares from the 1995/96 HES. Like in India, CPI weights in Bangladesh can and should be updated more frequently, exploiting the availability, regularity, and quality of the HIES data.

IV. SPATIAL PRICE CHANGES

Using unit prices from the HIES survey, we construct spatial price indices for clothing and footwear, housing, and food items[19] to contrast with the observed spatial dispersion (as implied by changes in poverty lines (PLs) over the 2005-2010 period). We do not suggest that the HIES nonfood price index is the correct measure, but we do believe it contains some signal on the spatial distribution of nonfood prices. And this distribution can help us assess the nonfood poverty lines. The constructed indices are presented in Table X and Figure 2, with rural Dhaka serving as the reference group. The survey-based nonfood price indices follow a similar pattern (and exhibit significant variation), but they do not fully coincide with those implied by the stratum-level, PL-based indices. In particular, when considering just the footwear and clothing indices, we observe that the spatial price dispersion implied by the survey-based index is lower relative to the PL-based index. On the other hand, as we take into account the dispersion due to differences in housing prices (i.e. non-food prices), the implied survey-based inflation rates are higher than the PL-based rates (Figure 3).

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[19]The items included in the construction of these indices are the same as those included in the construction of the temporal price indices.

TABLE X
SPATIAL PRICE INDICES

|	HIES Spatial Price Indices – 2010 (Base: Rural Dhaka)					Others set to 1 (i.e. no change)		Others set to mimic footwear and housing		Bangladesh poverty line-Based Spatial Price Indices – 2010 (Base: Rural Dhaka)		
Stratum	Footwear & Garment	Housing (Base: Rural)	Housing (Base: Rural, 3 groups)	Food	Non-Food	Overall	Overall (3 groups)	Overall	Overall (3 groups)	Food	poverty line-Non-Food	Overall
Barisal (Rural)	0.939	1.000	1.000	1.044	0.981	1.021	1.021	1.016	1.016	1.025	0.935	0.992
Barisal (Muni.)	1.072	2.181	1.580	1.146	1.422	1.214	1.148	1.456	1.390	1.147	1.603	1.311
Chittagong (Rural)	1.082	1.000	1.000	1.056	1.026	1.035	1.035	1.042	1.042	1.068	1.233	1.127
Chittagong (Muni.)	1.256	2.181	2.465	1.120	2.087	1.208	1.240	1.467	1.498	1.110	1.415	1.219
Chittagong (SMA)	1.265	2.181	2.465	1.185	2.090	1.245	1.276	1.504	1.536	1.093	1.539	1.253
Dhaka (Rural)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Dhaka (Muni.)	1.154	2.181	2.465	1.072	2.056	1.177	1.208	1.426	1.458	1.062	1.440	1.198
Dhaka (SMA)	1.297	2.181	2.465	1.184	2.100	1.246	1.277	1.508	1.540	1.137	1.761	1.361
Khulna (Rural)	1.050	1.000	1.000	0.952	1.016	0.976	0.976	0.980	0.980	0.922	1.023	0.959
Khulna (Muni.)	1.231	2.181	1.580	0.987	1.471	1.135	1.068	1.391	1.325	0.973	1.389	1.122
Khulna (SMA)	1.138	2.181	1.580	1.022	1.442	1.149	1.083	1.397	1.331	1.012	1.242	1.095
Rajshahi (Rural)	0.959	1.000	1.000	0.985	0.987	0.990	0.990	0.986	0.986	0.999	0.983	0.993
Rajshahi (Muni.)	1.100	2.181	1.580	1.027	1.430	1.150	1.084	1.394	1.328	1.030	1.110	1.059
Rajshahi (SMA)	1.168	2.181	1.580	0.998	1.451	1.137	1.071	1.388	1.322	0.971	1.161	1.039
Sylhet (Rural)	1.073	1.000	1.000	1.038	1.023	1.024	1.024	1.031	1.031	0.995	0.665	0.876
Sylhet (Muni.)	1.388	2.181	1.580	1.100	1.520	1.204	1.138	1.475	1.409	1.035	1.051	1.041

Source: Authors' own calculations using HIES 2005 and 2010.

Figure 2: **Spatial Price Indices**
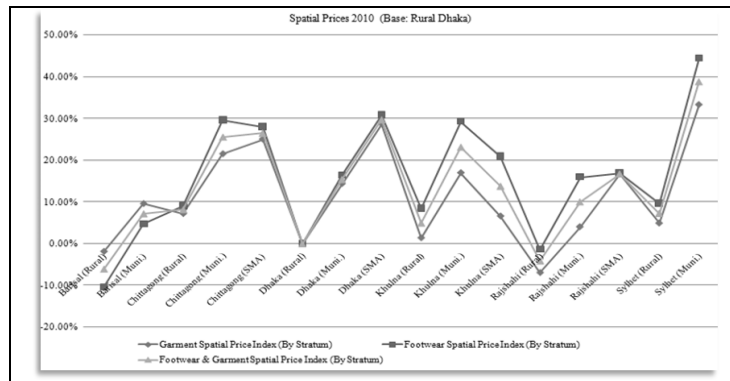
Source: HIES 2010.

Figure 3: **Non-food Poverty vs. Survey-Based Non-food Indices**
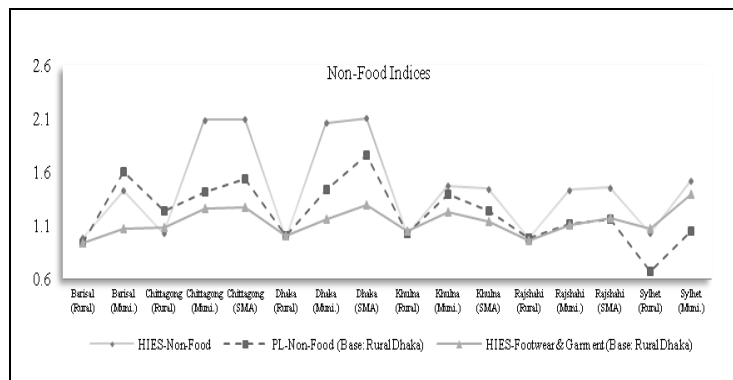
Source: HIES 2010.

Ravallion (1998) suggests the use of the methodology proposed by Lanjouw and Lanjouw (2001) in the presence of measurement error in non-food consumption and/or price changes. Lanjouw and Lanjouw (2001) demonstrate that, under certain assumptions (in particular, in the absence of mismeasurement in the data), poverty comparisons can be made regardless of the comprehensiveness of the data. In other words, measuring poverty using total expenditures should yield the same estimates as using a less comprehensive component of expenditures, such as the food component.

Table XI explores the Lanjouw and Lanjouw (2001) methodology at the national- and stratum-levels in Bangladesh. At the national-level, poverty estimates using total expenditures are similar to estimates using food expenditures. However, at the stratum-level, the differences are larger and

systematic. In particular, according to official numbers and relative to the food expenditure approach, poverty is underestimated in Barisal Rural, Khulna Rural, and Rajshahi Rural and Municipal (all of which are regions in the West). Poverty is overestimated for Barisal Municipal, Chittagong SMA, Dhaka Municipal, Khulna SMA, Rajshahi SMA, and Sylhet Municipal (all of which are non-rural areas). These systematic differences and the evidence presented earlier in the draft do not provide solid evidence in support of the BNPI, nor do they provide evidence for use of CPI.

TABLE XI
FOOD POOR VERSUS OVERALL POOR BY REGION

	Level	Poor	Food Poor	Diff. (percentage points)
National	National	0.32	0.31	0.85
	Rural	0.35	0.35	-0.17
	Urban	0.21	0.18	3.70
Division	Barisal	0.39	0.40	-0.16
	Chittagong	0.26	0.25	0.92
	Dhaka	0.31	0.28	2.60
	Khulna	0.32	0.32	0.45
	Rajshahi	0.36	0.37	-1.32
	Sylhet	0.28	0.27	1.51
Stratum	Barisal (Rural)	0.39	0.40	-0.84
	Barisal (Muni.)	0.40	0.37	3.24
	Chittagong (Rural)	0.31	0.30	0.68
	Chittagong (Muni.)	0.22	0.22	0.27
	Chittagong (SMA)	0.07	0.04	2.34
	Dhaka (Rural)	0.39	0.38	0.98
	Dhaka (Muni.)	0.30	0.25	4.72
	Dhaka (SMA)	0.15	0.10	5.10
	Khulna (Rural)	0.31	0.32	-1.41
	Khulna (Muni.)	0.32	0.28	4.18
	Khulna (SMA)	0.40	0.30	9.58
	Rajshahi (Rural)	0.37	0.38	-1.45
	Rajshahi (Muni.)	0.31	0.32	-1.47
	Rajshahi (SMA)	0.32	0.28	3.52
	Sylhet (Rural)	0.30	0.30	0.98
	Sylhet (Muni.)	0.15	0.11	4.45

Source: Authors' own calculations using HIES 2005 and 2010.

With the exception of Sylhet, the magnitude of the gaps between the spatial price differences (implied by the 2010 PLs and the survey-based price index) for footwear and ready-made garments (Figure 3) are associated with the differences in poverty headcounts (implied by food PLs versus overall PLs) (Table XI). In other words, whenever the food-based poverty headcount is lower than the upper PL poverty headcount, the spatial price differences implied by the PLs exceeds the price dispersion implied by the footwear and ready-made garment-based index.

V. CONCLUSION

The purpose of this study is to determine the best approach for measuring price changes in Bangladesh. First, we provide a brief recount of how inflation is measured and of how poverty lines were constructed/re-estimated in Bangladesh. Then, we analyze both the temporal and spatial aspects of inflation, as measured by the CPI, the BNPI and a HIES-based price index.

We find evidence that the poverty line in 2010, relative to 2005, seems to be somewhat greater in real terms. We provide a plausible explanation for the increase in real value of the official poverty lines by analyzing the relationship between the incidence of poverty and both per-capita consumption and changes in household demographics. Analysis shows that decreases in the number of household members (in particular, young children) are associated with significant increases in per-capita consumption. This result suggests that in the 2005-2010 period, as incomes rose and the number of household members declined, the relative cost of food increased, causing the value of Poverty lines to increase in real terms.

HIES-based temporal price indices suggest that the CPI may underestimate inflation as faced by the poor in Bangladesh. Furthermore, the indexes constructed using HIES data suggest that inflation, as experienced by the poor, is closer to what is implied by changes in the Poverty lines. A further piece of evidence in favor of using Poverty lines rather than the CPI to measure inflation faced by consumers is provided by a poverty headcount robustness check. In particular, following the methodology proposed by Lanjouw and Lanjouw (2001), we corroborate that the poverty headcount at the national-level is robust to consumption aggregates (i.e. both the food poverty line and the upper poverty line imply virtually the same poverty rate).

Evidence for spatial price indices constructed using the HIES is mixed. On the one hand, whenever the food-based poverty headcount is lower than the

upper poverty line-based poverty headcount, the spatial price differences implied by the Poverty lines exceed the price dispersion implied by the footwear and readymade garment-based index. When we take into account price dispersion due to differences in housing prices, we obtain the opposite result. Again, following the methodology suggested by Lanjouw and Lanjouw (2001), we are unable to corroborate that poverty headcounts at the stratum-level are robust to consumption aggregates (i.e. the food poverty line and the upper poverty line imply different poverty rates). In particular, we find that the gaps between the spatial prices (implied by the 2010 Poverty lines and the survey-based footwear and clothing price index) are associated with the differences in poverty headcounts implied by the food Poverty lines versus overall Poverty lines. Unlike the BNPI (which, by definition, is closer to a cost of living index), the survey-based price index intends to capture price differences across regions, regardless of whether or not utility levels are held constant. Ultimately, since both of the approaches for measuring spatial price differences have limitations, we argue that there is value in using the spatial price index as implied by the poverty lines (and agreed to by the Government of Bangladesh).

Hence, depending on whether we seek to measure absolute poverty, inequality, inflation faced by consumers, or aggregate-level inflation, we propose: (1) the use of the national poverty line-based price index (or BNPI) to make temporal comparisons; (2) the use of the national poverty line as the baseline for adjusting consumption when making cross-sectional poverty comparisons across regions; (3) the use of the survey-based spatial price indices when making cross-sectional inequality comparisons across regions; until a better measure of aggregate-level inflation is available, and (4) the use of the CPI for adjusting nominal macroeconomic aggregates.

Given the findings from this study as well as concerns raised by other researchers,[20] we also recommend that the construction of the CPI basket and, in particular, the non-food component be revised such that a more reliable/appropriate measure of consumer prices can be formulated for Bangladesh. Ideally, this price measure should be periodically validated as new rounds of HIES data are made available.

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[20]See, for example, the article published by the Policy Research Institute http://www.pri-bd.org/index.php?option=com_content&view=article&id=208:inflation-and-statistical-paradox&catid=47:bangladesh-economy&Itemid=59

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