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Understanding Poverty Reduction in Bangladesh: A Micro-Decomposition Approach[1]

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We quantify the contributions to poverty reduction observed in Bangladesh between 2000 and 2010. In contrast to methods that focus on aggregate summary statistics, the method adopted in this paper generates entire counterfactual distributions to account for the contributions of demographics, labor and non-labor incomes in explaining poverty reduction. We find that the most important contributor to poverty reduction was the growth in labor incomes, stemming from non-farm employment in the first half of the decade, and from farm employment during the second half of the decade. Labor income growth was driven by higher real wage premiums, pointing to productivity increases and an increase in the relative price of labor as the driving forces behind poverty reduction. Lower dependency rates and the benefits of a growing work force also helped to reduce poverty. Finally, non-labor income contributed to poverty reduction, albeit to a smaller extent, particularly in the form of international remittances. Going forward the main challenges will be to continue to provide jobs to a growing workforce and to ensure that new job creation is resilient to sudden changes in relative prices.

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JEL Codes: Q15, I24, J30

I. INTRODUCTION

Despite Bangladesh's exposure and vulnerability to several external and natural shocks, poverty incidence and depth has significantly fallen over the past

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decade.[2] What are the factors behind the observed changes in poverty and inequality? Was the observed reduction in poverty a result of higher employment, higher productivity, or higher remittances? Was it the result of changes in the sectoral composition of employment? Were these changes the result of improved human capital characteristics or higher returns (in the form of higher wages) given existing characteristics? Answers to these questions can contribute to the evidence base for policy going forward. For example, if declining dependency ratios were largely responsible for the reduction in poverty, then population projections can help to distinguish whether this is likely to continue going forward. To the extent that poverty reduction has had more to do with domestic employment and earnings rather than international remittances, this may highlight that greater effort should be placed in ensuring that the poor have access to good domestic jobs.

The existing literature proposes several methods for decomposition of poverty changes. The Datt-Ravallion (1992) method considered the standard decomposition method, separates poverty changes over time into a distribution-neutral growth effect, a redistributive effect, and a residual. Kolenikov and Shorrocks (2005) decompose variations in poverty into growth, distribution, and prices, while Ravallion and Huppi (1991) offer a way of decomposing changes in poverty over time into intrasectoral effects, population shifts effects, and an effect resulting from the interaction between sectoral changes and population shifts. A common feature of these decomposition methods is that their usefulness in policymaking is severely limited by the fact that they explain changes in poverty on the basis of changes in summary statistics that are hard to target with policy instruments (Ravallion 2001).[3] This limitation creates the need for methods that can capture the heterogeneity of impacts throughout the distribution, and that can disentangle the underlying forces behind the observed outcomes.

In this paper, we adapt the Bourguignon and Ferreira (2005) methodology to distinguish between distributional changes on account of changes in endowments (quantities) and returns to those endowments (prices). For instance, it is likely that higher educational attainment in the labor force would lead to higher incomes and therefore lower poverty. However, if the supply of educated

[2]This same experience is also shared by other countries in the world. A recent count of poverty episodes in the 2000s shows that in 80 out of 105 countries for which there is comparable data, the annual average reduction in poverty was above 0.25 percentage point.

[3] For a full review of micro-decomposition methods, see Essama-Nssah (2012).

workers outpaces the demand for such workers, then it is likely that the returns to higher education will fall as the wage premium for having higher levels of education falls. This idea is often associated with Tinbergen's (1975) "race" between technological progress –which he saw as raising the demand for skills— and the expansion of formal education—which raises the supply of skills (Ferreira 2012). Similarly, poverty could have been affected by changes in various individual characteristics or endowments, including the geographical, age, and gender structure of the population, the employment, sectoral, and occupational status of the labor force, and the returns (or wage premiums) associated with each of these characteristics. In addition, poverty could have declined due to changes in non-labor dimensions of household incomes, including international remittances, capital and social transfers among others. Application of these methods has mostly been used on income-based measures of poverty and inequality so far. Since most countries measure welfare through household expenditures or consumption, one contribution of this paper is that it modifies the existing methodologies to decompose consumption-based measures of poverty and inequality.

Our objective is to quantify, based on a series of counterfactual simulations, the contributions of different factors towards poverty reduction in Bangladesh over the last decade. In contrast to methods that focus on aggregate summary statistics, the method adopted in this paper generates entire counterfactual distributions, allowing us to decompose the contributions of changes in different sources of income and in individual and household characteristics to the observed distributional changes. Although these decompositions do not allow for the identification of causal effects, they are useful to focus attention on the elements that are quantitatively more important in describing changes in poverty.

The rest of the paper is organized as follows. Section II briefly discusses the data used for the analysis. Section III describes the evolution of poverty and economic growth in Bangladesh between 2000 and 2010 as well as the hypotheses that may explain the observed distributional changes over the period. Section IV presents a model of consumption and earnings, and describes the decomposition technique used to quantify the contributions of different factors in the observed distributional changes. Section V presents our results, and Section VI concludes.

II. DATA

This paper is based on microdata from the last three rounds of the Household Income and Expenditure Survey (HIES): 2000, 2005 and 2010. This data has

been collected by the Bangladesh Bureau of Statistics (BBS) on regular basis since 1973. The HIES is the core survey that provides information on household income, expenditure, and consumption. We use the official consumption aggregate constructed by the BBS as measure for welfare and used to measure poverty, along with the official poverty lines. The questionnaires for each of the rounds are almost identical allowing us to construct income and labor market variables that are comparable over time.[4] Note that several improvements have been made in the last round of HIES. Some of them were related to innovative techniques for data collection and others to the inclusion of four separate sub-modules in the questionnaire: disability, micro-credit, migration and remittances and, crisis and crisis management.[5] These changes were addressed when possible in the analysis to maintain comparability across surveys.

III. COUNTRY CONTEXT

Poverty in Bangladesh declined significantly between 2000 and 2010. The national poverty headcount fell by 1.7 percentage points per year during the past decade, a 17 percentage point decline (Figure 1). This reduction coincided with a period of uninterrupted strong economic growth which averaged 5.8 percent throughout the decade despite the occurrence of natural and external shocks. Bangladesh went through the international financial crisis of 2008 virtually unscathed (Figure 1).[6] Despite strong growth, and impressive poverty reduction, with a GDP per capita of US$ 1,710 and more than 70 percent of its population residing in rural areas, Bangladesh remains a primarily rural, low income country. Since continued growth and poverty reduction are needed to ensure the goal of reaching middle income status, understanding these links is important for policymaking going forward.

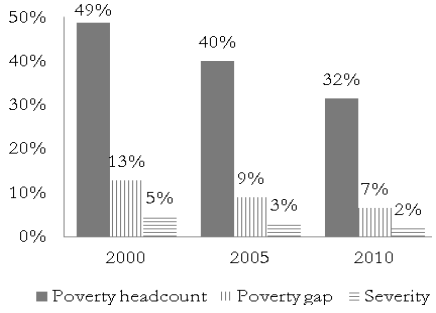
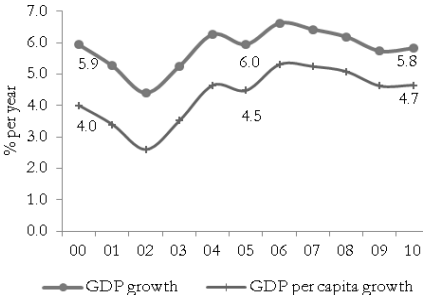
There is considerable evidence that economic growth is strongly and negatively correlated with changes in poverty (Ravallion and Chen 2007). Indeed, using the standard Datt-Ravallion decomposition, we find that growth does explain about 90 percent of the observed reduction in poverty between initial and final years (Figure 2 and Table I). However, over the last five years, less than 75 percent of the observed change in poverty was explained by growth

[4]For further information about how labor income and non-labor income variables were constructed as well as labor market status and price adjustment, see Data Annex: Chapter 3, World Bank (2013).
[5]HIES Survey Report 2010- BBS (2011)
[6]Bangladesh: Towards Accelerated, Inclusive and Sustainable Growth – Opportunities and Challenges. Report No. 67991, April 2012.

in mean income, whereas income redistribution explained more than 25 percent of these changes.

It is important to note, however, that while these estimates of the reduced-form relationship between economic growth, inequality and poverty help us identify empirical regularities, they do not help us make explicit the links between growth and poverty reduction (Ferreira 2010).[7] In particular, we would like to capture the heterogeneity of impacts throughout the distribution, and better understand the channels through which growth led to poverty reduction, including changes in demographics, sectoral, occupational and other labor and non-labor dimensions.[8]

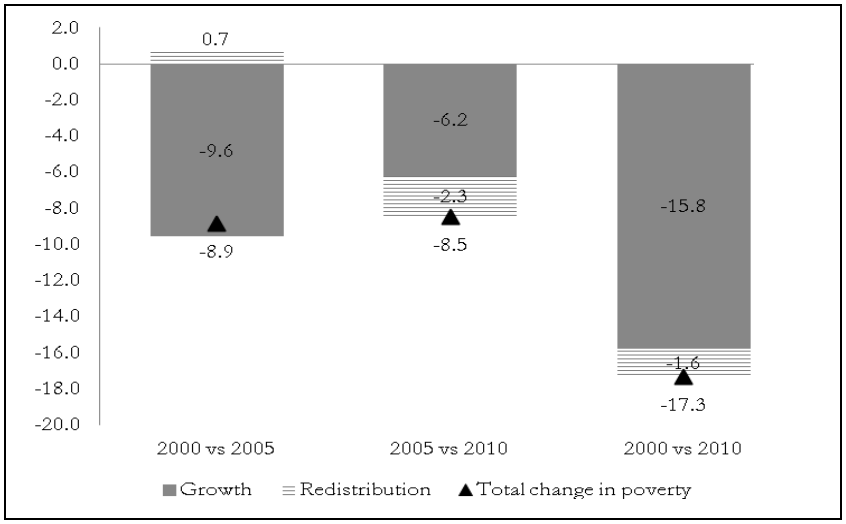
Figure 1: **Growth and Poverty Reduction**

A. Poverty Headcount National Moderate Poverty Lines	B. Real GDP Growth and Real GDP per capita Growth (annual percentage change)
	
Source: Own estimates based on HIES, 2000-2010.	**Source:** Bangladesh Bureau of Statistics (BBS).

[7]In statistics, and particularly in econometrics, the reduced form of a system of equations is the result of solving the system. In econometrics, "structural form" models begin from deductive theories of the economy, while "reduced form" models begin by identifying particular relationships between variables.

[8]Panel data that can track the life and labor histories of households over time can be used to answer questions about economic mobility and poverty dynamics. However, panels are often not available with the frequency required. Moreover, panel data are often not representative of the population as a whole; and if they initially are, it is unlikely that over the course of a decade the panel would remain representative of the population. Alternative methods using repeated cross sections have been used. One approach is to construct pseudo panels, which can delve into some issues of economic mobility (Lanjouw, Luoto, and McKenzie 2011) . However, these models are often troubled by their lack of precision and the fact that they often do not measure the contributions of different factors to poverty reduction.

Figure 2: **Growth and Redistribution Decomposition of Poverty Changes**



Source: Own estimates based HIES 2000, 2005, and 2010.

TABLE I

GROWTH AND REDISTRIBUTION DECOMPOSITION OF POVERTY CHANGES

	2000 vs 2005	2005 vs 2010	2000 vs 2010
FGT(0)			
t0	0.489	0.400	0.489
	0.012	0.003	0.012
t1	0.400	0.315	0.315
	0.003	0.009	0.009
Actual □c	-0.089	-0.085	-0.173
	0.012	0.009	0.015
Growth	-0.096	-0.062	-0.158
	0.016	0.004	0.016
Redistribution	0.007	-0.023	-0.016
	0.011	0.012	0.015
FGT(1)			
t0	0.128	0.090	0.128
	0.005	0.001	0.005

(Cont. Table I)

	2000 vs 2005	2005 vs 2010	2000 vs 2010
t1	0.090	0.065	0.065
	0.001	0.002	0.002
Actual □c	-0.038	-0.024	-0.062
	0.005	0.003	0.005
Growth	-0.038	-0.019	-0.056
	0.006	0.001	0.006
Redistribution	0.000	-0.005	-0.006
	0.005	0.004	0.006
FGT(2)			
t0	0.046	0.029	0.046
	0.002	0.000	0.002
t1	0.029	0.020	0.020
	0.000	0.001	0.001
Actual □c	-0.017	-0.009	-0.026
	0.002	0.001	0.002
Growth	-0.016	-0.007	-0.023
	0.003	0.001	0.003
Redistribution	-0.001	-0.001	-0.003
	0.002	0.002	0.003

Source: Own estimations based HIES 2000, 2005, and 2010.

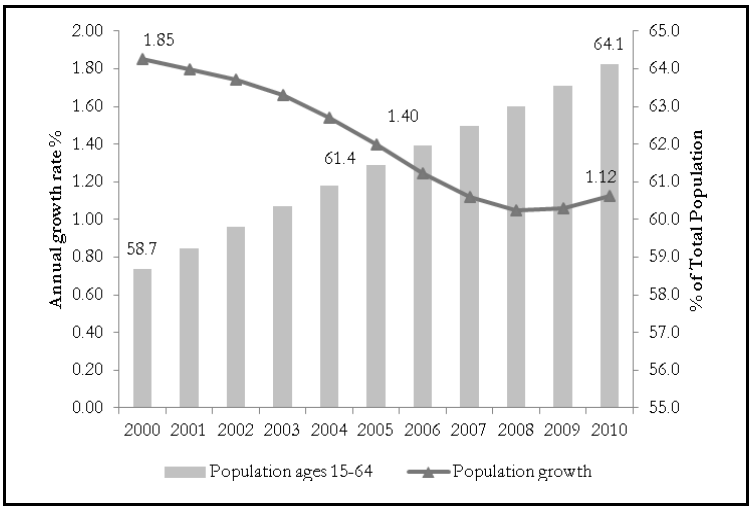
3.1 Elements that could Impact Poverty Reduction

The poverty reduction experienced in Bangladesh over the last decade can be attributed to a large number of factors. On the one hand, population growth has considerably slowed down. On the other hand, the youth bulge observed in earlier periods has now reached working age (Figure 3).[9] These simultaneous changes are evidenced by the observed decrease in average household size as well as the increase in the share of adults per household (Figure 4 and Table II). A greater number of adults per household generally implies lower dependency rates and, under the assumption that the labor market is able to absorb these potential new entrants, the possibility of higher consumption per-capita. Moreover, simple summary statistics reveal that, despite the observed population

[9]Despite this deceleration, Bangladesh has added 19 million people to its total population, a 15 percent increase between 2000 and 2010. See Chapter 4 for further details.

growth, labor force participation remained relatively stable and the employment-to-population ratio increased over the decade, particularly for women between 2005 and 2010 (Figure 5 and Table II).[10] Outside of demographic changes, we know growth was responsible for a large share of poverty reduction, but the question is how this growth was translated to poverty reduction. One clear channel at the household level is that the share of occupied (working) adults has increased, pointing to a potential increase in consumption attributable to higher employment (Table II). An important question then becomes: how significant was the effect of higher employment on the observed decline in poverty during the past decade?

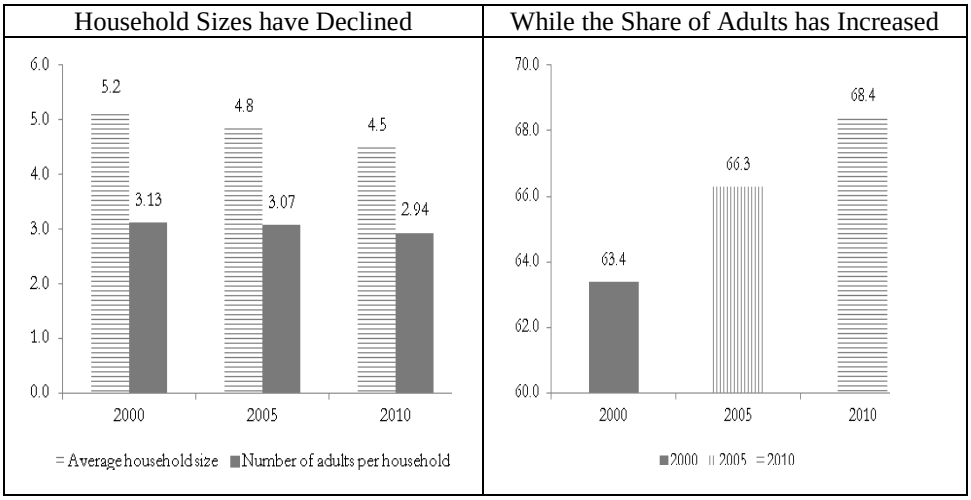
Figure 3: **Demographic Changes, Population Growth and Population ages 15-64 (annual percentage change and percent of total population)**



Source: World Bank. *World Development Indicator*s.

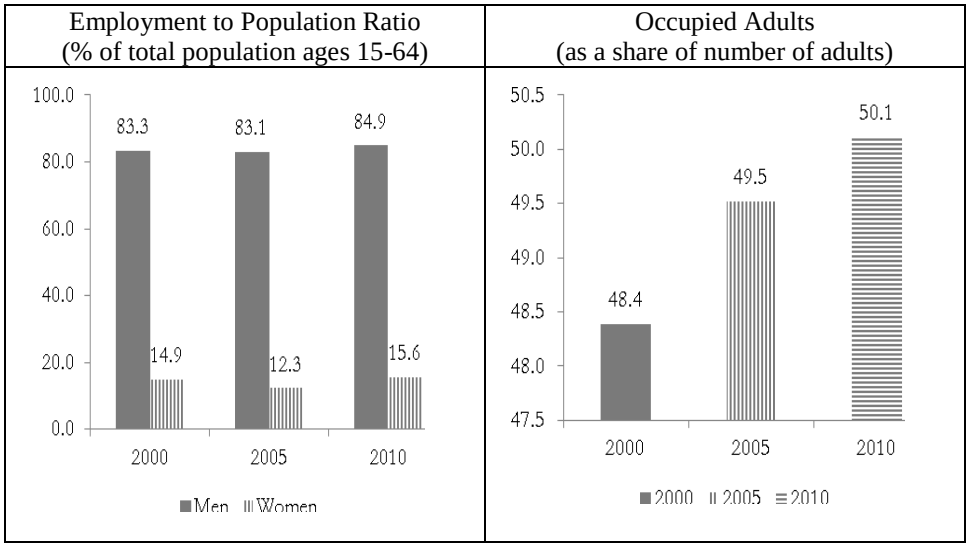
[10]In order to maintain comparability and consistency across HIES rounds and with the previous poverty assessment (World Bank 2008), we follow the same definitions for labor force participation and employment. These definitions are based on the income section of the questionnaire. For instance, a person is classified as employed either if he (she) self-identifies as being an unpaid family worker or if any wage or self-employed income is recorded. See Paci and Sasin (2008), World Bank – Bangladesh (2008), and Sasin (2009).

Figure 4: **Demographic Characteristics**



Source: Own Estimates based on HIES 2000, 2005, and 2010.

Figure 5: **Labor Force and Employment**



Source: Own Estimates based on HIES 2000, 2005, and 2010.

TABLE II

CHARACTERISTICS OF THE POPULATION AND LABOR FORCE

	2000	2005	2010
Population and demographics			
Total (millions)	71.0	81.9	89.8
Men (percent of total)	50.4	49.9	48.4
Women (percent of total)	49.6	50.1	51.6
Rural (percent of total)	78.2	73.3	72.0
Urban (percent of total)	21.8	26.7	28.0
Average household size	5.2	4.8	4.5
Number of adults per household	3.13	3.07	2.94
Share of adults per household	63.4	66.3	68.4
Occupied adults (as a share of number of adults)	48.4	49.5	50.1
Labor force participation (percent of working age population)			
All	49.4	47.6	49.2
Men	83.3	83.1	84.9
Women	14.9	12.3	15.6
Employment (percent of working age population)			
All	46.6	47.1	47.8
Men	81.6	82.3	82.9
Women	11.1	12.1	14.8
Unemployment (percent of labor force)			
All	5.6	1.1	1.4
Men	2.0	1.0	2.0
Women	25.9	1.7	0.8
Education levels (percent of working age population)			
Illiterate & Incomplete primary	57.2	49.8	47.1
Complete primary & lower secondary	33.8	40.3	43.4
Higher secondary & Tertiary	8.9	9.9	9.4
Labor relation (percent of employed population)			
Daily workers	33.5	32.3	32.4
Self-employed	46.3	45.2	42.3

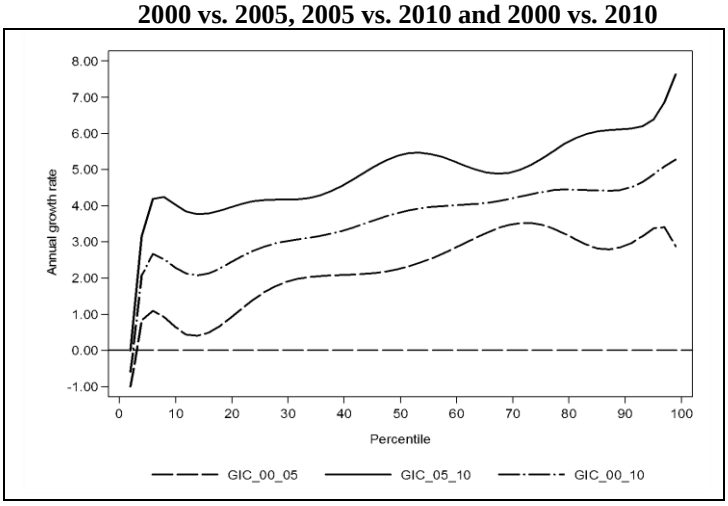
(Cont. Table II)

	2000	2005	2010
Salaried	20.2	22.5	25.4
Economic Sector (percent of employed population)			
Agriculture	49.2	44.3	41.8
Manufacturing	22.9	23.8	24.4
Services	27.9	32.0	33.7
Area (percent of employed population)			
Rural	78.6	73.4	71.6
Urban	21.4	26.6	28.4

Source: Own estimations based HIES 2000, 2005, and 2010.
Note: Working age population includes individuals between 15 and 64 years old.

In addition to higher employment rates, another possibility for how growth led to poverty reduction is through increases in labor productivity. At the household level, we find that the income derived from working increased. As shown in the growth incidence curves in Figure 6, labor income per-capita has grown throughout the decade, growing at a faster rate in the latter half of the decade. The top of the income distribution saw labor incomes grow faster than the bottom of the distribution. Nevertheless growth across the income distribution was substantial, suggesting that labor income had an important influence on moving people out of poverty.

Figure 6: **Labor Income Growth Incidence Curves Bangladesh, 2000 vs. 2005, 2005 vs. 2010 and 2000 vs. 2010**



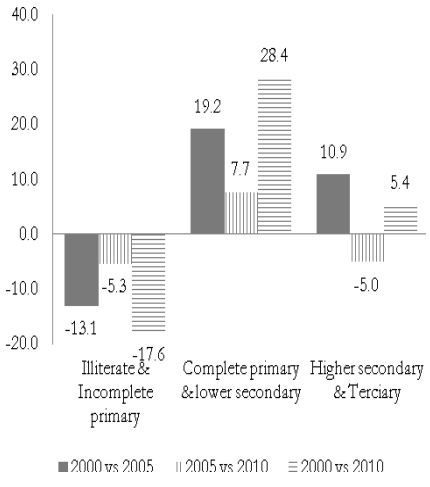
Source: Own estimates based on HIES 2000, 2005, and 2010.

Another potential contributor to both growth and poverty reduction is the shift in the educational structure of the population. Over the last ten years, improvements in the educational composition of the workforce are evidenced by a reduction in the percentage of illiterates as well as an increase in the share having completed primary and lower secondary school (Figure 7-A). Furthermore, we observe an urbanization process, evidenced by large population shifts from rural to urban regions occurring during the first part of the decade (Figure 7-B). During the second half of the decade, however, educational improvements and urbanization slowed down.

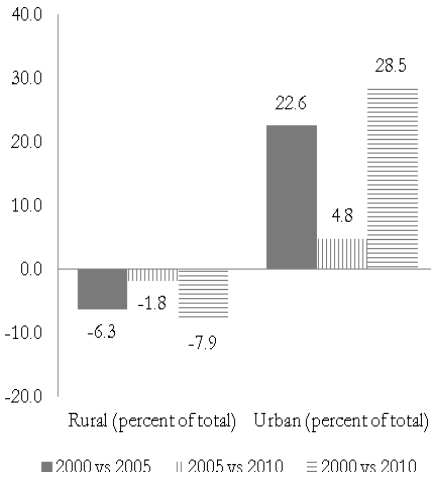
Finally, high growth and poverty reduction could be the result of changes in the occupational structure of the labor force which occurred as workers moved away from daily work and self-employed activities and instead toward salaried employment, where labor incomes and productivity are likely to be higher (Figure 8-A). In addition, consistent with trends for indicators of macroeconomic activity, employment shifted away from agriculture and toward manufacturing and services, although this shift decelerated during the second half of the decade (Figure 8-B).

Figure 7: **Changes in the Structure of Working Age Population**

A. Education levels (percent change of working age population)



B. Urban Population as a Share of Total (percent change working age population)



Source: Own estimates based on HIES 2000, 2005, and 2010.

Figure 8: **Changes in the Structure of Employed Population**

A. Occupational Structure (percent change in employed population)

B. Economic Sector (percent change in employed population)

Source: Own estimates based on HIES 2000, 2005, and 2010.

With regard to transfers, Figure 9 shows that both public and private transfers have grown steadily, the former increasing by 65 percent over the decade. Although the substantial increase in public transfers suggests that the growth in non-labor income serves as a partial explanation for some of the observed reduction in poverty, the importance of public transfers in explaining poverty reduction depends on the effectiveness of this spending, particularly in terms of targeting and in generating the right behavioral incentives among the poor. With regard to private transfers, while international remittances have almost tripled in Bangladesh over the last decade, significant constraints, such as the high out-of-pocket cost of migration and the need to rely on informal sources of finance, highly skew access to migration opportunities and international remittances in favor of upper income groups (World Bank 2012).

Finally, since the official poverty measure uses a household consumption aggregate, one might see a decline in poverty simply if households decided to save less and consume more. One way to check for this is to look at the consumption-to-income ratio across households. However, note that there are always measurement errors in both income and consumption, which we cannot separate from changes in savings behavior. Figure 10 shows that, on average, the consumption-to-income ratio increased in the first half of the decade and then fell

in the second half. The same pattern was observed for the lowest deciles of the distribution. To the extent that households consumed a lower share of their income at the end of the decade when compared to the beginning of the decade, the reduction in poverty may have been lower than if the consumption-to-income ratio had remained constant.

In the present study, we adapt the Bourguignon and Ferreira (2005) methodology to distinguish which of these changes has been most important in reducing poverty. We now turn to the proposed model.

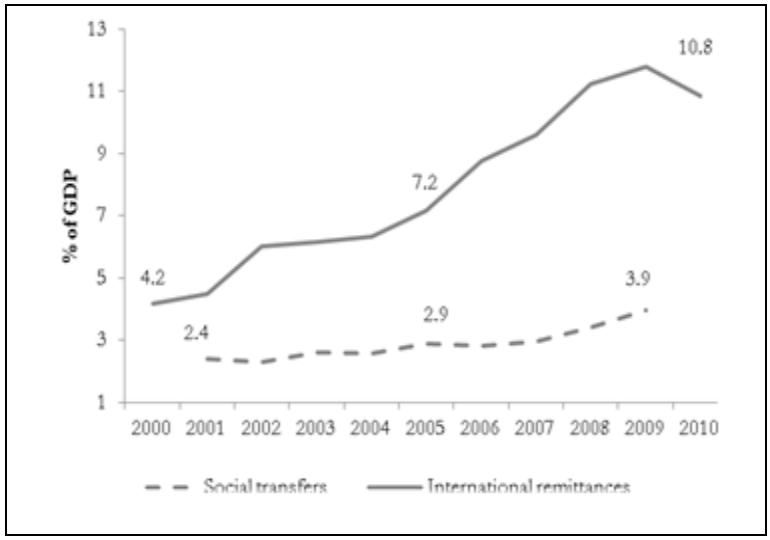
TABLE III
CONSUMPTION TO INCOME RATIO

	2000	2005	2010
Average	1.26	1.36	1.22
Deciles (per capita income)			
1	3.69	4.22	3.46
2	1.39	1.56	1.53
3	1.14	1.32	1.29
4	1.07	1.16	1.13
5	1.05	1.08	1.03
6	1.01	1.02	0.92
7	0.97	0.95	0.83
8	0.95	0.85	0.76
9	0.88	0.81	0.67
10	0.76	0.65	0.50
Spearman rank	0.79	0.63	0.56
Correlation	0.62	0.53	0.18
Coefficient of Variation			
Consumption	0.87	0.80	0.78
Income	1.06	1.19	2.99

Source: Own estimates based on HIES 2000, 2005, and 2010.

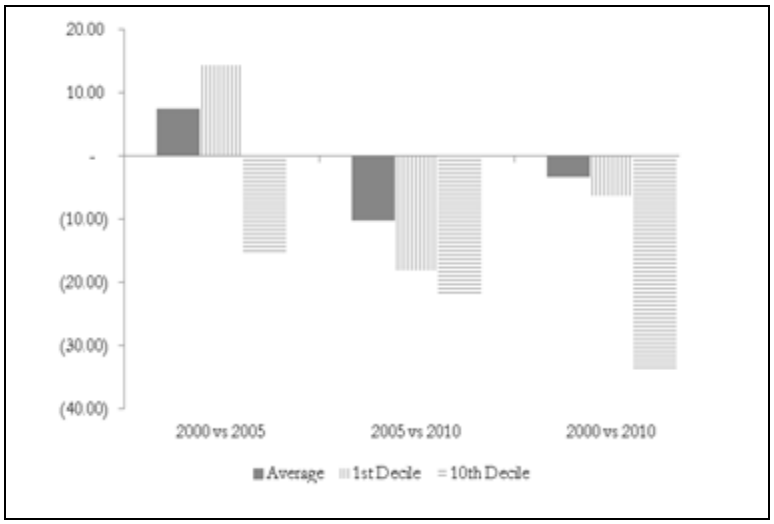
Note: Household consumption as a share of total household income.

Figure 9: **Non-Labor Income Growth Subsidies and Other Social Transfers and International Remittances (percent of GDP)**



Source: WDI (2011).

Figure 10: **Change in Household Consumption to Income Ratio**



Source: HIES 2000, 2005, and 2010.

IV. DECOMPOSITION METHOD

4.1 The Model

In contrast to methods that focus on aggregate summary statistics, the micro-decomposition methods used in this study generate series of simulations of entire counterfactual distributions to account for the contributions of demographics, labor incomes, and non-labor incomes to poverty reduction. Underlying the decomposition is a simple model of household consumption. In particular, consumption per-capita in household h is defined by:

$$C_h = \frac{1}{n}[\theta_h y_h] \quad (1)$$

where n is the number of people in household *h*, θ_h is the consumption to income ratio, and y represents household income. The consumption-to-income ratio depends on the average propensity to consume in household *h*. Empirically,θ_h may also capture measurement error or underreporting of household income. If we further disaggregate income into its sources, we can rewrite (1) as:

$$C_h = \frac{\theta_h}{n}\left[y_h^w + y_h^d + y_h^{se} + \pi_h^F + y_h^{NL}\right] \quad (2)$$

where y_h^w, y_h^d and y_h^{SE} are household salaried labor, daily labor11, and self-employed (nonfarm) labor income, respectively; π_h^F is the farm household net revenue function; and y_h^{NL} is household non-labor income. We slightly modify the Bourguignon and Ferreira (2005) approach and model the household income generating function as:

$$y_h = \left[\sum_{i=1}^{n} I_{hi}^w y_{hi}^w(X_{hi}, \Omega^w) + \sum_{i=1}^{n} I_{hi}^d y_{hi}^d\left(X_{hi}, \Omega^d\right) + \sum_{i=1}^{n} I_{hi}^{se} y_{hi}^{se}(X_{hi}, \Omega^{se}) + \pi_h^F\left(W_h, \Omega^F\right) + y_h^{NL}\right] \quad (3)$$

where I_{hi}^w, I_{hi}^d, and I_{hi}^{se} are indicator variables which are equal to one if individual i in household h is a salaried, daily, or self-employed worker, respectively; y_{hi}^w , y_{hi}^d, and y_{hi}^{se} are the corresponding earnings of individual i in household h and

[11]Daily workers in Bangladesh are agricultural or non-farm workers who are hired on a daily basis rather than continually into one or more jobs. They are classified separately as they could potentially belong to multiple sectors, seamlessly transitioning between agricultural and non-farm work. Note that they tend to be less educated and generally disadvantaged in terms of asset ownership compared to other types of workers.

depend on individual and household endowments (X_{hi}) and the returns to those endowments (Ω); π_h^F is household net revenue in farm activities, which depends on household endowments (W_{hi}) and the returns to these endowments; and y_h^{NL} is household non-labor income.

The allocation of individuals across occupations is represented through a multinomial logit model (McFadden 1974a, 1974b), specified as follows:

$$I_{hi}^s = 1 \text{ if } Z_{hi}\Psi^s + v_i^s > Max\left(0, Z_{hi}\Psi^j + v_i^j\right), j = 1, \dots, J, \forall j \neq s \quad (4)$$

$$I_{hi}^s = 0 \text{ for all } s = 1, \dots, J \text{ if } Z_{hi}\Psi^s + v_i^s \leq i \text{ for all } s = 1, \dots, J$$

where Z_{hi} is a vector of characteristics specific to individual i and household h; Ψ^s are coefficient vectors, for the following activities j = {salaried, daily worker, self-employed, not employed; and v_i^s are random variables identically and independently distributed across individuals and activities according to the law of extreme values. Within a discrete utility-maximizing framework, $Z_{hi}\Psi^s + v_i^s$ is interpreted as the utility associated with activity s, with v_i^s as the unobserved utility determinants of activity s and the utility of inactivity arbitrarily set to 0. Similarly, following Bourguignon, Ferreira, and Leite (2008), we estimate a multinomial logit model for an individual's education level and sector of employment. This estimation allows for a representation of the occupational, sectoral, and educational composition of the work force.

Once the composition of the workforce is determined, we then model the heterogeneity in individual earnings for each occupation type j using a log-linear Mincer model:

$$\log(y_{hi}^j) = X_{hi}\Omega^j + \varepsilon_{hi}^j \text{ for } i = 1, \ n_h \quad (5)$$

where X_{hi} is a vector of individual characteristics, Ω^j a vector of coefficients, and ε_{hi}^j is a random variable identically and independently distributed across individuals, according to the standard normal law. Farm net revenue is modeled as:

$$\log \pi_h^F = W_h\Omega^F + \varepsilon_h^F \quad (6)$$

where $W_h = (K_h, X_h)$ include endowments and household characteristics. As before, Ω^F are coefficient vectors, and ε_h^F are random variables following a standard normal distribution.

4.2 Implementation

The objective of this model is to distinguish the importance of changes in earnings and consumption attributable to changes in educational attainment, age, gender, occupational, sectoral, and geographical distributions of the labor force. In order to quantify the contribution of each income component to poverty reduction, the decomposition is implemented in four stages.

First, the determinants of occupational choice, sectoral choice and educational level are separately estimated for each period. Tables IV and V report both the actual shares for each survey year along with the simulated shares for household heads and for other family members, respectively.[12] Overall, the simulated shares are close to the true shares, indicating that the underlying specifications of these models can be used to simulate shifts in the composition and structure of the labor force.[13]

[12]Tables A1 and A2 in the Appendix (available from authors upon request) present the multinomial logit regression results for occupational choice for household heads and other members, respectively. Given the considerable diversification of sources of income that is common in rural households (see Davis *et al.* 2010), we estimate the sectoral choice model for the secondary occupation of individuals in farm households. Results of these regressions are available upon request. Similarly, the educational and sectoral choice models are available upon request.

[13]P-values of Pearson Chi-squared tests confirm that each simulated distribution is not statistically different from the actual distribution.

TABLE IV
SIMULATING THE CHARACTERISTICS OF HOUSEHOLD HEADS

	2000			2005			2010		
	Actual	Simulated		Actual	Simulated		Actual	Simulated	
		2005	2010		2000	2010		2000	2005
Education Structure									
Illiterate & Incomplete primary	63.2	61.7	61.9	57.7	59.0	57.6	57.0	57.8	56.9
Primary & Low Secondary	29.0	29.6	29.6	32.6	32.4	32.6	33.1	33.2	33.2
High Secondary & Tertiary	7.7	8.7	8.5	9.7	8.7	9.8	9.9	9.0	9.9
P-value of Pearson chi-square		*0.918*	*0.944*		*0.934*	*0.999*		*0.956*	*1.000*
Occupation									
Non-employed	9.6	8.7	10.1	7.0	7.5	7.5	8.0	7.7	6.9
Daily workers	45.5	42.3	40.7	45.2	49.0	44.1	43.4	49.9	45.4
Self-employed - Non Agriculture	24.7	25.3	25.1	23.5	22.3	23.3	24.1	23.9	25.3
Salaried	20.2	23.7	24.2	24.3	21.2	25.2	24.5	18.6	22.5
P-value of Pearson chi-square		*0.812*	*0.716*		*0.848*	*0.992*		*0.495*	*0.926*
Economic Sectors									
Daily workers									
-Agriculture	58.8	57.4	56.4	50.3	51.5	50.4	51.8	51.8	52.1
-Manufacturing	12.3	13.5	12.8	10.3	9.8	10.5	12.6	13.1	12.9
-Industry	7.9	8.2	8.5	11.2	11.4	11.6	11.9	12.3	11.3
-Services	21.0	21.0	22.4	28.2	27.3	27.5	23.7	22.8	23.7
P-value of Pearson chi-square		*0.984*	*0.969*		*0.994*	*0.998*		*0.995*	*0.998*
Self-employed									
-Manufacturing	34.9	35.5	35.3	31.4	30.4	30.9	17.6	17.0	16.9
-Industry	6.2	6.9	7.8	5.5	5.8	6.7	1.7	1.9	2.2
-Services	58.9	57.6	57.0	63.1	63.8	62.4	80.7	81.1	81.0
P-value of Pearson chi-square		*0.938*	*0.785*		*0.971*	*0.866*		*0.985*	*0.933*
Salaried									
-Agriculture	8.6	6.7	7.3	5.7	6.7	4.9	5.4	6.9	5.8
-Manufacturing	27.7	27.5	26.8	26.6	27.8	28.2	33.4	34.3	32.1
-Industry	3.7	4.0	3.8	5.2	5.2	5.0	3.9	4.0	4.3
-Services	60.0	61.8	62.2	62.6	60.3	62.0	57.3	54.9	57.2
P-value of Pearson chi-square		*0.919*	*0.958*		*0.956*	*0.975*		*0.919*	*0.987*

Source: Own estimates based on HIES 2000-2010.

TABLE V
SIMULATING THE CHARACTERISTICS OF OTHER HOUSEHOLD MEMBERS

	2000			2005			2010		
	Actual	Simulated		Actual	Simulated		Actual	Simulated	
		2005	2010		2000	2010		2000	2005
Education Structure									
Illiterate & Incomplete primary	54.4	54.1	54.5	45.9	45.7	46.2	42.1	42.3	41.9
Primary & Low Secondary	36.2	36.2	36.0	44.0	44.5	43.6	48.6	48.2	48.8
High Secondary & Tertiary	9.5	9.7	9.6	10.1	9.8	10.2	9.3	9.4	9.3
P-value of Pearson chi-square		*0.996*	*0.998*		*0.994*	*0.996*		*0.996*	*0.999*
Occupation									
Non-employed	79.8	79.2	83.0	78.3	79.3	81.3	78.0	80.1	79.1
Daily workers	8.6	8.4	4.7	8.4	8.4	4.7	8.2	5.6	5.7
Self-employed - Non Agriculture	4.4	4.8	4.8	5.2	5.0	5.8	4.1	4.4	4.7
Salaried	7.2	7.7	7.5	8.2	7.3	8.1	9.7	9.9	10.6
P-value of Pearson chi-square		*0.996*	*0.586*		*0.991*	*0.618*		*0.809*	*0.806*
Economic Sectors									
Daily workers									
-Agriculture	54.8	55.3	53.4	47.5	49.5	47.6	42.7	44.1	45.6
-Manufacturing	19.0	17.3	18.3	20.4	18.6	20.5	21.5	20.4	18.4
-Industry	8.4	9.6	8.9	11.4	11.0	11.3	15.8	16.4	15.8
-Services	17.8	17.9	19.4	20.8	20.8	20.6	20.0	19.2	20.2
P-value of Pearson chi-square		*0.952*	*0.968*		*0.969*	*1.000*		*0.985*	*0.885*
Self-employed									
-Manufacturing	41.1	42.0	45.7	36.5	34.0	38.2	26.8	22.1	26.1
-Industry	7.1	5.9	6.9	6.4	5.2	6.6	3.1	2.6	2.4
-Services	51.8	52.1	47.4	57.1	60.8	55.2	70.1	75.4	71.5
P-value of Pearson chi-square		*0.890*	*0.630*		*0.720*	*0.927*		*0.515*	*0.897*
Salaried									
-Agriculture	4.4	4.2	3.4	4.7	6.1	4.4	3.0	3.7	2.8
-Manufacturing	42.6	39.9	42.4	41.7	43.6	44.3	47.3	47.5	44.8
-Industry	2.5	2.5	2.0	2.9	2.9	2.6	2.6	2.7	2.9
-Services	50.5	53.3	52.2	50.8	47.4	48.9	47.2	46.0	49.6
P-value of Pearson chi-square		*0.953*	*0.942*		*0.858*	*0.966*		*0.973*	*0.962*

Source: Own estimates based on HIES 2000-2010.

As a second step, labor income is separated into farm and non-farm income in order to estimate the earnings regressions for each period, estimated separately for household heads and for other household members. Regressions are run for each of four groups: (1) salaried; (2) self-employed; (3) daily workers; and (4) net farm revenue for farm households. Tables VI through VII present results for individuals engaged in non-farm activities. The results show that the models fit the data relatively well, with coefficients being statistically significant and of the right sign. In all cases, higher earnings are associated with being male, having higher education and experience, living in urban areas, and belonging to the manufacturing sector. Table VIII presents results of net revenue for farm households.[14] As expected, net revenue for farmers increases with experience, land acres, access to irrigation, and the number of members participating in farm work.

In the third step, coefficients from these second step regressions are used to simulate counterfactual distributions by changing one variable at a time and by observing the effect of each change on the distribution. For instance, since we estimate the returns to education in three periods, we can take the estimated parameters in the first period (t0) and evaluate the earnings equations with the levels of education of the second period (t1). This generates counterfactual earnings at the individual level, which can then be aggregated to get the corresponding household income using equation (3), which can then be used to get to a counterfactual level of consumption according to (1), and therefore a counterfactual poverty rate. By changing one parameter at a time or one characteristic at a time, we obtain multiple counterfactual distributions and poverty rates. The methodology for estimating each counterfactual distribution and the associated counterfactual poverty rate is detailed in the Methodological Annex (available from authors upon request).

Fourth, the counterfactual poverty rates are compared to the observed poverty rates in order to quantify the impact of each element on poverty reduction. Since applying the first period parameters to the last period data will yield results that are different from applying the last period parameter to the first period data, the counterfactuals are calculated in both directions for every pair of years and the average counterfactual is reported. In effect, we estimate the

[14]Net revenue was calculated using the available information on total revenue stemming from agricultural production and the cost of inputs from detailed household enterprise modules included in the surveys.

marginal contributions of each factor since the parameter estimates are obtained by changing one element at a time, while leaving all other elements constant.

Given that changes in multiple factors could have interaction effects, we also calculate the cumulative effect of these decompositions. To calculate this effect, we follow the methodology proposed by Bourguignon, Ferreira and Leite (2008) and begin by sequentially calculating the effects on poverty of changes in the characteristics of the population, beginning with age and gender, followed by changes in geographical, educational, occupational, and sectoral structure of the population. With these results we then calculate changes in farm and nonfarm earnings, on account of changes in the returns to these characteristics, followed by changes in non-labor incomes, and finally, changes in the consumption-to-income ratio.

It is important to note two important caveats: path dependence and equilibrium-inconsistency. As recognized in the literature (Bourguignon and Ferreira 2005) path dependency may lead to results that are sensitive to the order in which the variables are simulated. This is typical of decomposition techniques, and the best way known to remedy it is to calculate the decomposition across all possible paths and then take the average. These are also known as the Shapley-Shorrocks estimates of each component.[15] To deal with the large set of variables we consider, we group these variables into smaller sets and then calculate the Shapley-Shorrocks estimates of these. The results from this exercise are used to inform whether path dependency is likely to have a significant impact in the results. With regard to the second caveat, since we are modifying only one element at a time, the counterfactuals are not the result of an economic equilibrium, but rather a simulation exercise in which we assume that we can in fact modify only one factor at a time and keep everything else constant. While we are unable to address this caveat, the fact that the decomposition approach used in this paper is nevertheless useful in quantifying the relative importance of each of the factors considered in describing distributional changes lessens this concern.

[15]See Shapley (1953) and Shorrocks (2013).

TABLE VI
NON-FARM EARNINGS – HOUSEHOLD HEADS
(Individuals between 15 and 64 years old)

	2000			2005			2010		
	Daily workers	Self-employed (1)	Salaried	Daily workers	Self-employed (1)	Salaried	Daily workers	Self-employed (1)	Salaried
Primary & Lower secondary	0.132***	0.370***	0.330***	0.100***	0.350***	0.308***	0.0530***	0.312***	0.357***
	(0.0392)	(0.0484)	(0.0499)	(0.0241)	(0.0413)	(0.0465)	(0.0150)	(0.0387)	(0.0387)
Higher secondary & Terciary	0.420**	0.994***	0.796***	0.440***	0.941***	0.782***	0.248***	0.632***	0.826***
	(0.164)	(0.0810)	(0.0551)	(0.131)	(0.0659)	(0.0509)	(0.0654)	(0.0625)	(0.0420)
Age	0.0510***	0.0591***	0.0529***	0.0328***	0.0571***	0.0482***	0.0224***	0.0411***	0.0916***
	(0.00989)	(0.0186)	(0.0161)	(0.00616)	(0.0152)	(0.0136)	(0.00426)	(0.0149)	(0.0117)
Age squared	-0.000666***	-0.000664***	-0.000570***	-0.000415***	-0.000663***	-0.000475***	-0.000267***	-0.000541***	-0.00107***
	(0.000119)	(0.000219)	(0.000191)	(7.39e-05)	(0.000180)	(0.000162)	(5.09e-05)	(0.000172)	(0.000138)
Female	-0.894***	-1.477***	-0.956***	-0.665***	-1.226***	-0.594***	-0.688***	-1.080***	-0.709***
	(0.0621)	(0.166)	(0.0849)	(0.0417)	(0.122)	(0.0734)	(0.0266)	(0.138)	(0.0609)
Urban	0.0863*	0.234***	0.108**	-0.0210	0.210***	0.0224	-0.0217	0.264***	0.117***
	(0.0447)	(0.0495)	(0.0421)	(0.0243)	(0.0415)	(0.0367)	(0.0164)	(0.0396)	(0.0315)
Barisal	0.0601	-0.193**	-0.0421	-0.0124	0.0254	-0.236***	0.0120	-0.0592	-0.0989
	(0.0641)	(0.0966)	(0.0880)	(0.0424)	(0.0854)	(0.0776)	(0.0293)	(0.0857)	(0.0671)
Chittagong	-0.0891*	-0.0956	-0.0181	0.212***	0.0676	0.202***	0.0488**	-0.152**	-0.0456
	(0.0461)	(0.0622)	(0.0521)	(0.0286)	(0.0658)	(0.0453)	(0.0194)	(0.0597)	(0.0405)
Khulna	0.103**	-0.108	-0.0193	0.0383	0.0171	0.00712	-0.216***	-0.212***	-0.184***
	(0.0478)	(0.0747)	(0.0677)	(0.0300)	(0.0698)	(0.0626)	(0.0194)	(0.0621)	(0.0506)
Rajsahi	-0.182***	-0.242***	-0.195***	-0.0138	-0.136***	-0.00594	-0.179***	-0.314***	-0.112**
	(0.0364)	(0.0589)	(0.0610)	(0.0247)	(0.0503)	(0.0542)	(0.0160)	(0.0466)	(0.0454)
Sylhet	-0.0841	-0.183	-0.370***	0.137***	0.306***	-0.129	-0.0994***	0.302***	-0.0124
	(0.0604)	(0.131)	(0.111)	(0.0441)	(0.0781)	(0.0801)	(0.0298)	(0.0846)	(0.0812)
Manufacturing	0.432***		0.446***	0.396***		0.231***	0.0674***		0.107
	(0.0456)		(0.0780)	(0.0316)		(0.0792)	(0.0196)		(0.0699)
Industry	0.178***	0.00876	0.433***	0.421***	0.0872	0.217**	0.272***	-0.0833	0.250**
	(0.0547)	(0.0962)	(0.121)	(0.0307)	(0.0879)	(0.102)	(0.0201)	(0.146)	(0.0969)
Services	0.429***	-0.0220	0.403***	0.391***	-0.0116	0.233***	0.111***	-0.0844*	0.0882
	(0.0379)	(0.0472)	(0.0740)	(0.0221)	(0.0420)	(0.0752)	(0.0156)	(0.0475)	(0.0670)
Public job			0.178***			0.224***			0.320***
			(0.0452)			(0.0405)			(0.0393)
Constant	6.395***	6.636***	6.256***	6.675***	6.657***	6.406***	7.190***	7.164***	5.698***
	(0.198)	(0.386)	(0.334)	(0.125)	(0.315)	(0.283)	(0.0872)	(0.317)	(0.248)
Observations	2092	1269	1134	2829	1531	1532	3390	2007	1820
R-squared	0.216	0.240	0.401	0.245	0.260	0.321	0.289	0.183	0.373
Adj R-squared	0.211	0.232	0.393	0.241	0.253	0.314	0.286	0.177	0.368

Notes: (1) Self-employed in Non-agriculture
Dhaka is the base region
Illiterate and Incomplete primary education is the base for education levels
Agriculture is base sector for Daily and Salaried while Manufacturing is base sector for Self-employed in Non-Agriculture
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source: Own estimates based on HIES 2000-2010.

TABLE VII

NON-FARM EARNINGS – OTHER MEMBERS

(Individuals between 15 and 64 years old)

	2000			2005			2010		
	Daily workers	Self-employed (1)	Salaried	Daily workers	Self-employed (1)	Salaried	Daily workers	Self-employed (1)	Salaried
Primary & Lower secondary	0.133**	0.449***	0.459***	0.0293	0.234***	0.439***	0.0492**	0.0246	0.292***
	(0.0554)	(0.0831)	(0.0674)	(0.0363)	(0.0651)	(0.0486)	(0.0211)	(0.0676)	(0.0372)
Higher secondary & Terciary	0.114	0.975***	0.837***	0.210	0.715***	0.814***	0.466***	0.331***	0.954***
	(0.270)	(0.124)	(0.0854)	(0.203)	(0.0966)	(0.0612)	(0.0992)	(0.107)	(0.0478)
Age	0.0514***	0.0693***	0.0478***	0.0425***	0.0574***	0.0958***	0.0384***	0.124***	0.0693***
	(0.0131)	(0.0222)	(0.0178)	(0.00949)	(0.0147)	(0.0117)	(0.00593)	(0.0167)	(0.00975)
Age squared	-0.000633***	-0.000774**	-0.000444	-0.000521***	-0.000548**	-0.00114***	-0.000470***	-0.00170***	-0.000846***
	(0.000203)	(0.000350)	(0.000282)	(0.000149)	(0.000223)	(0.000183)	(9.17e-05)	(0.000246)	(0.000153)
Female	-1.078***	-1.244***	-0.682***	-0.957***	-0.831***	-0.406***	-0.691***	-1.132***	-0.462***
	(0.0698)	(0.121)	(0.0656)	(0.0502)	(0.0783)	(0.0418)	(0.0301)	(0.0841)	(0.0331)
Urban	-0.0135	0.0209	-0.147**	-0.000481	0.0855	-0.149***	-0.104***	0.287***	-0.0407
	(0.0737)	(0.0803)	(0.0619)	(0.0475)	(0.0607)	(0.0405)	(0.0276)	(0.0615)	(0.0316)
Barisal	0.216*	-0.0186	-0.228*	-0.167**	-0.0541	-0.257***	0.0885*	0.156	-0.0396
	(0.111)	(0.151)	(0.124)	(0.0842)	(0.131)	(0.0809)	(0.0502)	(0.127)	(0.0752)
Chittagong	-0.200***	-0.123	-0.178**	0.0361	0.100	0.170***	0.101***	-0.149*	-0.0281
	(0.0756)	(0.101)	(0.0704)	(0.0538)	(0.0808)	(0.0477)	(0.0321)	(0.0883)	(0.0388)
Khulna	-0.107	-0.0433	-0.215*	-0.142**	-0.0310	-0.269***	-0.204***	-0.297***	-0.237***
	(0.0855)	(0.121)	(0.117)	(0.0574)	(0.0996)	(0.0726)	(0.0338)	(0.0907)	(0.0562)
Rajsahi	-0.227***	-0.396***	-0.295***	-0.119**	-0.162**	-0.294***	-0.103***	-0.00253	-0.0741
	(0.0665)	(0.103)	(0.0910)	(0.0466)	(0.0760)	(0.0624)	(0.0281)	(0.0756)	(0.0481)
Sylhet	-0.231**	-0.481***	-0.636***	0.132*	0.328***	-0.119	0.0448	0.125	-0.0857
	(0.103)	(0.166)	(0.125)	(0.0718)	(0.110)	(0.0795)	(0.0389)	(0.112)	(0.0741)
Manufacturing	0.300***		0.463***	0.176***		0.251***	-0.169***		0.149*
	(0.0674)		(0.145)	(0.0460)		(0.0934)	(0.0274)		(0.0904)
Industry	0.448***	-0.0366	0.440**	0.326***	0.0989	0.305**	0.174***	0.700***	0.0853
	(0.0897)	(0.148)	(0.221)	(0.0566)	(0.117)	(0.138)	(0.0296)	(0.171)	(0.126)
Services	0.469***	0.0881	0.297**	0.345***	0.0454	0.182*	0.0930***	0.195***	-0.0847
	(0.0692)	(0.0777)	(0.144)	(0.0448)	(0.0591)	(0.0931)	(0.0276)	(0.0707)	(0.0905)
Public job			0.555***			0.371***			0.437***
			(0.0921)			(0.0606)			(0.0522)
Constant	6.270***	6.379***	6.198***	6.538***	6.503***	5.676***	6.974***	5.456***	6.227***
	(0.192)	(0.334)	(0.285)	(0.140)	(0.231)	(0.194)	(0.0892)	(0.273)	(0.163)
Observations	1153	673	1104	1552	1021	1470	1857	973	1984
R-squared	0.307	0.317	0.285	0.288	0.239	0.359	0.383	0.343	0.348
Adj R-squared	0.299	0.304	0.275	0.281	0.229	0.352	0.379	0.334	0.343

Notes: (1) Self-employed in Non-agriculture

Dhaka is the base region

Illiterate and Incomplete primary education is the base for education levels

Agriculture is base sector for Daily and Salaried while Industry is base sector for Self-employed in Non-Agriculture

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Source: Own estimates based on HIES 2000-201.

TABLE VIII
FARM EARNINGS
(Individuals between 15 and 64 years old)

	2000	2005	2010
Primary & Lower secondary	0.132**	0.0732	0.0331
	(0.0633)	(0.0463)	(0.0489)
Higher secondary & Tertiary	0.295**	0.479***	-0.00290
	(0.147)	(0.103)	(0.119)
Age	0.142***	0.0976***	0.0795***
	(0.0214)	(0.0153)	(0.0172)
Age squared	-0.00175***	-0.00110***	-0.000843***
	(0.000245)	(0.000172)	(0.000190)
Female	-2.243***	-1.661***	-0.926***
	(0.123)	(0.0662)	(0.0605)
Urban	0.197	-0.00530	-0.161**
	(0.123)	(0.0781)	(0.0816)
Barisal	-0.285**	-0.177*	0.270***
	(0.123)	(0.0907)	(0.0920)
Chittagong	-0.240**	0.0481	0.164**
	(0.0977)	(0.0665)	(0.0680)
Khulna	0.405***	0.345***	0.204***
	(0.0955)	(0.0730)	(0.0751)
Rajshahi	0.0125	0.297***	0.303***
	(0.0763)	(0.0557)	(0.0629)
Sylhet	0.0104	0.0697	0.253**
	(0.126)	(0.106)	(0.108)
Low land	-0.107	0.609***	0.743***
	(0.0986)	(0.0669)	(0.0666)
High land	0.457***	1.095***	1.333***
	(0.111)	(0.0772)	(0.0786)
Irrigation	0.458***	0.276***	0.408***
	(0.0941)	(0.0732)	(0.0707)
Number of members	0.525***	0.496***	0.429***
	(0.0507)	(0.0458)	(0.0525)
Constant	4.007***	4.077***	4.780***
	(0.462)	(0.344)	(0.381)
Observations	1678	2612	2956
R-squared	0.340	0.400	0.323
Adj R-squared	0.334	0.396	0.320

Notes: Sample: Self-employed in Agriculture
Dhaka is the base region
Illiterate and Incomplete primary education is the base for education levels
No-land is the base category
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source: Own estimates based on HIES 2000-2010.

V. MICRO-DECOMPOSITION RESULTS

As mentioned earlier, we decompose how changes in endowments or characteristics as well as the returns to those endowments contributed to poverty reduction. In each case, this is like referring to how changes in quantities (or endowments) affected poverty reduction, versus how changes in the price of those endowments did so (changes in the returns to endowments are changes in the wage premiums on account of those endowments). Table IX presents the decomposition results when we look at the contribution to poverty reduction taking only one factor at a time, which we refer to as "marginal contributions." Table X presents a further dissagregation of the returns to endowments when considering only one factor at a time. In contrast, Table XI recognizes that there may be important interactions between the factors that contribute to poverty reduction, and allows for these interactions by estimating the "cumulative contributions" of all of the factors at a time.

The results show that the largest contributor to poverty reduction over the 2000-2010 decade was the increase in the returns to endowments or characteristics, rather than changes in these endowments, pointing to an increase in the relative price of labor and higher productivity as the main contributors to poverty reduction. In particular, returns to farm and non-farm endowments accounted for about 60 percent of poverty reduction, concentrated in rural agricultural farm households. The fact that the reduction in poverty was concentrated among rural, agricultural farm households may be counterintuitive at first, as conventional wisdom calls for diversification to reduce the risk of falling into poverty.

Beyond these broad results, the decompositions highlight significant differences in the contributors to poverty reduction between the first and the second halves of the decade.[16] In the 2000-2005 period, the observed reduction in poverty was related to employment diversification; whereas in the 2005-2010 period, poverty reduction was associated with increasing returns to farming. In particular, during the first half of the decade, the contribution attributable to higher returns to non-farm endowments was twice as large as the contribution of returns to farm endowments. In contrast, in the second half of the decade, returns to non-farm endowments amounted to only one-tenth of the contribution of higher returns to farm endowments. The results hold when analyzing marginal

[16]Note that we divide the decade into 2000-2005 and 2005-2010 because these are the periods for which household surveys are available.

contributions, i.e., changing only one factor at a time, as well as cumulative contributions, i.e., simultaneously changing all factors (Table XI).

TABLE IX
MARGINAL CONTRIBUTIONS TO THE CHANGE IN POVERTY HEAD COUNT RATIO

	2000-2005		2005-2010		2000-2010	
	Percentage point change	Share of total change	Percentage point change	Share of total change	Percentage point change	Share of total change
A. LABOR INCOME						
I. Non-Farm Labor Income						
Returns to characteristics	-3.54	39.9	-0.66	7.8	-3.52	20.3
Occupational-choice	-0.09	1.0	-0.65	7.6	-1.61	9.3
Economic Sector	-0.44	4.9	0.07	-0.9	-0.48	2.8
Education	-0.58	6.5	0.05	-0.6	-0.55	3.1
Unobservable factors	1.30	-14.7	0.56	-6.6	1.59	-9.2
II.Farm Labor Income						
Returns to characteristics	-1.64	18.5	-6.27	73.9	-6.98	40.2
Occupational-choice	0.35	-4.0	0.17	-2.1	0.56	-3.2
Education	-0.20	2.2	0.32	-3.8	0.13	-0.8
Unobservable factors	0.24	-2.8	0.12	-1.4	0.26	-1.5
B. NON-LABOR INCOME						
Capital	0.55	-6.2	0.74	-8.7	1.31	-7.5
Domestic Transfers	0.36	-4.0	1.02	-12.0	1.10	-6.3
International Transfers	-0.51	5.8	-1.33	15.7	-1.94	11.2
Other transfers	0.30	-3.4	0.28	-3.3	0.58	-3.3
C. OTHER						
Age-gender-regional structure	-2.35	26.6	-2.17	25.6	-4.41	25.4
Consumption to income ratio	-2.89	32.6	5.06	-59.7	0.93	-5.4
Unexplained	0.26	-2.9	-5.81	68.4	-4.34	25.0
Total	-8.86	100.0	-8.49	100.0	-17.34	100.0

Source: Own estimates based on HIES 2000-2010.

TABLE X
CONTRIBUTIONS TO THE CHANGE IN POVERTY HEAD COUNT RATIO- PARAMETER EFFECTS

	2000-2005				2005-2010				2000-2010			
	Nonfarm Households		Farm Households		Nonfarm Households		Farm Households		Nonfarm Households		Farm Households	
	Percent point change	Share of total change	Percent point change	Share of total change	Percent point change	Share of total change	Percent point change	Share of total change	Percent point change	Share of total change	Percent point change	Share of total change
Returns to characteristics	**-3.54**	**39.9**	**-1.64**	**18.5**	**-0.66**	**7.8**	**-6.27**	**73.9**	**-3.52**	**20.3**	**-6.98**	**40.2**
Education	1.07	-12.0	0.19	-2.1	0.87	-10.2	0.70	-8.3	1.77	-10.2	0.78	-4.5
Experience	3.68	-41.5	6.01	-67.8	2.62	-30.9	2.08	-24.5	3.94	-22.7	4.19	-24.2
Female	-0.50	5.7	-0.23	2.6	0.12	-1.4	0.01	-0.1	-0.44	2.6	-0.20	1.1
Urban premium	0.57	-6.4	0.02	-0.2	-0.59	7.0	0.51	-6.0	0.11	-0.6	0.45	-2.6
Dhaka premium	-4.76	53.7	-1.98	22.3	3.43	-40.4	-0.20	2.3	-0.87	5.0	-1.82	10.5
Manufacturing and service sector premium	2.09	-23.6	0.14	-1.6	4.96	-58.5	0.09	-1.1	5.85	-33.7	0.21	-1.2
Returns to Land			-6.21	70.1			-1.43	16.9			-7.25	41.8
Irrigation			0.18	-2.0			0.15	-1.8			0.30	-1.8
Other members			0.04	-0.5			1.27	-14.9			1.48	-8.5
Constant	-4.92	55.5	-0.10	1.1	-11.73	138.2	-7.31	86.2	-14.87	85.7	-7.74	44.7

Source: Own estimates based on HIES 2000-2010.

TABLE XI
CUMULATIVE CONTRIBUTIONS TO THE CHANGE IN POVERTY HEAD COUNT RATIO

	2000-2005		2005-2010		2000-2010	
	Percentage point change	Share of total change	Percentage point change	Share of total change	Percentage point change	Share of total change
Population	-2.35	26.6	-2.17	25.6	-4.41	25.4
Education	-0.81	9.2	-0.05	0.6	-0.88	5.1
Occupation	-0.57	6.4	-0.52	6.2	-1.38	8.0
Sector	-0.55	6.2	0.07	-0.8	-0.51	2.9
Returns nonfarm	-3.49	39.3	-0.50	5.9	-2.93	16.9
Returns farm	-1.90	21.5	-7.77	91.5	-8.18	47.1
Residuals nonfarm	1.04	-11.8	0.55	-6.4	1.39	-8.0
Residuals farm	0.38	-4.3	-0.07	0.8	-0.06	0.4
International remittances	-0.71	8.0	-1.31	15.5	-1.93	11.2
Others	0.10	-1.1	3.29	-38.80	1.55	-9.0
Total	-8.86	100.0	-8.49	100.0	-17.34	100.0

Source: Own estimates based on HIES 2000-2010.

During the first part of the decade, the higher returns to non-farm endowments coincided with significant sectoral shifts in employment, in particular, from agriculture to manufacturing and services. These shifts suggest that growth in the manufacturing and service sectors attracted workers to activities with higher returns, thereby having a greater impact on individuals in non-farm households. Relative to workers from farm households, workers from non-farm households likely had more suitable characteristics, networks or proximity to the types of jobs the economy was creating; these differences likely explain why workers from non-farm households benefited more. While the shift to manufacturing and services continued over the second half of the decade, the growth in agriculture gained momentum during the second half of the decade (as opposed to only 2.7 percent as in the first half of the decade).[1] Moreover, an increase in the relative price of commodities, as opposed to an increase in productivity, may potentially explain the observed increase in the value of farm labor during the second half of the decade.

[1]Although this increase in growth was not enough to increase agriculture's share in total GDP, it was large enough to maintain the same share as the first five years of the decade.

5.1 Demographic and Regional Effects

Strong growth in the working-age population and, consequently, lower dependency rates also had an important impact in poverty reduction throughout the decade. As shown in Tables IX and X, changes in the age, gender, and regional composition of the workforce accounted for 25 percent of the observed decline in poverty between 2000 and 2010. Given that mostly young people, who generally earn less than their more experienced counterparts, entered the workforce, the increase in the size of the workforce was countered by lower returns to work for young workers (Table X). Nevertheless, the ensuing lower dependency rate was a large contributor to poverty reduction. Similarly, the growing share of women in the labor force also contributed to poverty reduction, and the marginal effect of this change was larger in the first half of the decade, particularly in the non-farm sector (Table X).

In terms of regional composition, the share of the working-age population living in Barisal decline by 14 percent between 2000 and 2010. Similarly, Chittagong, and Sylhet experienced small declines in their work-forces, particularly in the second half of the decade. In contrast, Dhaka and Rajshahi experience small increases in their working age population share. How did these changes contribute to poverty reduction? Table X shows that the earnings penalty for living outside of Dhaka fell over the last decade, but particularly so for non-farm workers during the first part of the decade. This reduction in the earnings penalty points to an increase in the relative price of labor and/or higher productivity outside of Dhaka as significant poverty-reducing factors. This factor was more important for the Eastern regions relative to the Western ones,[18] where movements away from Chittagong and Sylhet likely increased the supply of labor in Dhaka, and therefore reduced the premium to moving to the capital, particularly in the second part of the decade. In contrast, the returns to farming increased, leading to a 10.5 percent reduction in poverty. Higher returns to non-farm work in cities outside of Dhaka contributed an additional five percent to overall poverty reduction over the course of the decade, particularly during the first part of the decade.

[18]The East region includes: Dhaka, Chittagong and Sylhet and the West region: Barisal, Khulna and Rajshahi. The majority of daily and self-employed in farm workers are located in the West, while salaried and self-employed in non-farm workers are in the East.

5.2 Education and Experience

As expected, more educated and experienced population helped to reduce poverty, particularly in the non-farm sector. Improvement in educational attainment of the workforce accounted for three percent of the observed poverty reduction between 2000 and 2010, mostly stemming from the non-farm sector and having a negligible impact among farm workers (Table IX). However, given the large increase in more educated workers, relative earnings for these workers declined. Interestingly, while the large increase in the share of the population that completed primary school (Table II) led to a slight reduction in poverty in the non-farm sector, it also drove down the premium for completing primary school for nearly all, excepting salaried, workers. As a result, the poverty-reducing impact of a more educated workforce was partially offset by a decline in the returns to primary education (Table X).

Since the baseline group (omitted category) is comprised of individuals with no schooling, these results indicate an increase in demand for unskilled workers over the course of the decade, which served as an important poverty-reducing factor (see coefficient corresponding to the constant in Table X). This increase in demand affected both farm and non-farm daily and self-employed workers (Tables VI-VIII). This implies that increases in the educational attainments of the population have been faster than the growth in the demand for their labor. Overall, the results point to an important increase in the relative price of unskilled labor, which may, at least in part, have been driven by higher productivity or higher food prices, particularly in the case of agricultural workers (World Bank 2013).

5.3 Occupation

As workers sought to benefit from growth through better work opportunities, changes in the occupational structure of non-farm workers also played an important role in poverty reduction. In the non-farm sector, the shift from daily and self-employed work toward salaried employment accounted for 9.3 percent of the reduction in poverty over the decade (Table IX).[19] This effect was stronger in the second half relative to the first half of the decade.

[19]The cumulative effects for the entire decade are larger because they include all occupational changes including the choice between daily-workers, salaried and self-employed work for non-farm workers, and the choice to have a secondary occupation for farm workers.

In contrast, workers who remained in agriculture, farmers in particular, experienced greater specialization and by the end of the decade were less likely to diversify into a secondary occupation. The share of farmers with a secondary occupation fell from 30 to 10 percent over the decade. The lower level of diversification, which was partly due to an increase in the returns to farm activities, resulted in a three percent increase in poverty in the last 10 years (Table X).

5.4 Sector of work

Changes in the sectoral composition of employment also affected poverty reduction, both due to changes in the quantity of workers in each industry, as well as due to the change in the prices that these workers were able to obtain from working in different sectors. In particular, non-farm households shifted away from agriculture and into manufacturing and services. This shift is one of the channels through which growth could lead to poverty reduction, as it is associated with a five percent reduction in poverty over the first half of the decade. However, as the returns to agriculture increased in the second half of the decade, movements away from agriculture led to a slight increase in poverty. Moreover, the returns to work in manufacturing and services substantially declined over the decade. Therefore, although the shift into the manufacturing and service sectors accounted for three percent of the observed poverty reduction between 2000 and 2010 (Table IX), this was entirely offset by a reduction in prices, namely in the manufacturing and service sector wage premia, leading to a net higher poverty rate than would have otherwise been expected (Table X).

5.5 Farm Net Revenue and Rural Assets

Greater returns to farm characteristics and endowments imply an increase in the real value of output per worker, which would have also been reflected in higher economic growth, and may indeed be one of the channels through which growth has led to poverty reduction. This finding holds for all farms, regardless of characteristics, as expressed by the 45 percent contribution to poverty reduction captured by the constant (Table X). However, the fraction of this increase attributable to an increase in real productivity resulting from higher capital investments, as opposed to from an increase in relative prices, cannot be disentangled. Nevertheless, given that this period was characterized by an increase in commodity prices, the effect of this price spike on the real value of agricultural production likely was an important driver of the observed increase in agricultural returns.

In addition to the overall increase in returns to farming experienced by farm households, the most important contributor to poverty reduction was the increase in returns to land, accounting for 42 percent of the reduction in poverty (Table X). This increase in the premium for owning land is perhaps due to the fact that households have smaller land holdings. For example, the average land size declined from 0.8 to 0.6 acre per capita between 2000 and 2010. Still, the contribution of returns to land to poverty reduction was slightly offset by lower premiums to irrigation and a greater number of workers.

5.6 Non-labor Income

Although much of the reduction in poverty was due to labor income growth, non-labor income also played a role, albeit relatively smaller. The increase in international remittances over the decade was associated with an 11 percent decline in poverty, most of which occurred during the second half of the decade. Still, the poverty declined attributable to international remittances was offset by a decline in both domestic transfers and other non-labor concepts (such as capital and other transfers) that led to slightly higher poverty rate than if they had remained constant (Table IX).[20]

VI. CONCLUSIONS

The last decade affords us a fantastic opportunity to study the most significant factors that were at work in favor of the poor in Bangladesh. The objective of this paper is to quantify, based on a series of counterfactual simulations, the contributions of different factors towards poverty reduction in Bangladesh over the last decade. Our results show that the most important contributor to poverty reduction over the last decade was economic growth which led to poverty reduction through the growth in wage premiums (or higher returns to endowments), particularly for farm workers. The results also reveal stark contrasts in the nature of poverty reduction experienced in the first relative to the second part of the decade.

During the first part of the decade, the increase in non-farm wages was the most important factor contributing to poverty reduction, which was driven by a

[20]The contribution of international remittances to poverty reduction increased from around 6 percent in the first half of the decade to 16 percent during the latter half. This pattern coincided with the stronger growth in international remittances taking place over the second half of the decade (Figure 7) but could also be influenced by better micro-data collection over time. For instance, the last round of HIES includes a new module on migration and remittances which has likely improved the quality of remittance data.

declining earnings penalty for living outside of Dhaka. Paralleling this wage increase, three "poverty-reducing" shifts also took place: workers moved away from agriculture and toward manufacturing and service sector employment; workers moved away from daily and self-employed work and toward salaried jobs; and the level of education of the workforce increased. These changes point to likely increases in productivity during the first part of the decade as the source for higher wage premiums. In contrast, during the second half of the decade, poverty reduction occurred primarily in the farm sector. In particular, the farm sector experienced a significant increase in labor income, which was not associated with higher education or changes in occupation. Instead, it was associated with an increase in relative prices, likely due to the increase in food prices. Apart from labor income growth, changes in the demographic composition of the population, in particular, lower dependency ratios on account of the larger adult population, also helped to reduce poverty over the decade. Likewise, international remittances played a significant, albeit smaller role in reducing poverty.

The results point to potential challenges and opportunities for continued poverty reduction going forward. First, to the extent that the working-age population continues to grow, the economy can continue to reap the economic dividends from this demographic change, so long as the labor market continues to accommodate the growing workforce. Although it is true that rural households are also purchasers of food, the results in this study show that to the extent that high commodity prices continue to prevail, poverty reduction is likely to continue in rural areas, where a large share of the poor live. However, this is also reminder that growth and poverty reduction in Bangladesh continue to be vulnerable to price fluctuations. In contrast, the type of poverty reduction observed in the first part of the decade, on account of movements toward non-farm work, calls for policies to ensure that the demand for salaried work continues to grow resiliently such that the progress made thus far is not lost. Simultaneously, continued efforts to expand the quantity and quality of education will go a long way in guaranteeing the needed supply of skilled workers.

REFERENCES

Bangladesh Bureau of Statistics. 2011. *Household Income and Expenditure Survey Report 2010*. Dhaka, Bangladesh.

Bourguignon, F., and F. H. G. Ferreira. 2005. "Decomposing Changes in the Distribution of Household Incomes: Methodological Aspects." In F. Bourguignon, F. H. G. Ferreira, and N. Lustig, eds., *The Microeconomics of Income Distribution Dynamics in East Asia and Latin America*. Washington, D.C.: The World Bank.

Bourguignon, F., Ferreira, F. H. G., and P. G. Leite. 2008. "Beyond Oaxaca-Blinder: Accounting for Differences in Households Income Distributions." *Journal of Economic Inequality*, 6(2): 117-148.

Datt, G., and M. Ravallion. 1992. "Growth and Redistribution Components of Changes in Poverty Measures: A Decomposition with Applications to Brazil and India in the 1980s." *Journal of Development Economics*, 38: 275-296.

Davis, B., Winters, P., Carletto, G., Covarrubias, K., Quiñones, E. J., Zezza, A., Stamoulis, K., Azzarri, C., and S. DiGiuseppe. 2010. "A Cross-Country Comparison of Rural Income Generating Activities." *World Development*, 38(1): 48-63.

Essama-Nssah, B. 2012. "Identification of Sources of Variation in Poverty Outcomes." World Bank Policy Research Working Papers No. 5954. The World Bank, Washington, D.C.

Ferreira, F. 2010. "Distributions in Motion: Economic Growth, Inequality and Poverty Dynamics." World Bank Policy Research Working Paper No. 5424. The World Bank, Washington, D.C.

_____2012. "Distributions in Motion: Economic Growth, Inequality, and Poverty Dynamics." In *The Oxford Handbook of the Economics of Poverty*, edited by Philip N. Jefferson, 427–62. New York: Oxford University Press.

Kolenikov, S., and A. Shorrocks. 2005. "A Decomposition Analysis of Regional Poverty in Russia." *Review of Development Economics*, 9(1): 25-46.

Lanjouw, P., Luoto, J., and D. McKenzie. 2011. "Using Repeated Cross-Sections to Explore Movements into and out of Poverty" World Bank Policy Research Working Paper No. 5550. The World Bank, Washington,D.C..

D.C.McFadden, D. 1974a. "Conditional Logit Analysis of Qualitative Choice Behavior." In P. Zarembka, ed., *Frontiers in Econometrics*. New York, N.Y.: Academic Press.

_____1974b. "The Measurement of Urban Travel Demand." *Journal of Public Economics*, 34: 63-82.

Paci, P., and M. Sasin. 2008. *Making Work Pay in Bangladesh: Employment, Growth, and Poverty Reduction*. Washington D.C.: The World Bank.

Ravallion, M. and M. Huppi. 1991. "Measuring Changes in Poverty: A Methodological Case Study of Indonesia during an Adjustment Period." *The World Bank Economic Review*, 5 (5): 57-82.

Ravallion, M. 2001. "Growth, Inequality and Poverty: Looking Beyond Averages." *World Development*, 29 (11): 1803-15.

Ravallion, M. and S. Chen. 2007: "China's (Uneven) Progress Against Poverty." *Journal of Development Economics*, 82 (1): 1-42.

Sasin, M. 2009. "Making Work Pay: Growth, Employment and the Labor Market in Bangladesh." In A. Narayan and H. Zaman, eds., *Breaking Down Poverty in Bangladesh*, Chapter 4, 109-133. Dhaka, Bangladesh.

Shapley, L. 1953. "A Value for N-Person Games." In: H. W. Kuhn and A. W. Tucker, eds., *Contributions to the Theory of Games* (vol. 2). Princeton, N.J.: Princeton University Press.

Shorrocks, A. F. 2013. "Decomposition Procedures for Distributional Analysis: A Unified Framework Based on Shapley Value." *Journal of Economic Inequality*, 11(1): 99-126.

World Bank. 2005. *World Development Report 2006: Equity and Development*. Washington, D.C.: The World Bank and Oxford University Press.

_____2008. "Poverty Assessment for Bangladesh: Creating Opportunities and Bridging the East-West Divide." Paper No. 26. Dhaka, Bangladesh.

_____2011. *World Development Indicators*. Available at: http://data.worldbank.org/data-catalog/world-development-indicators

_____2012. *Bangladesh: Towards Accelerated, Inclusive and Sustainable Growth – Opportunities and Challenges*. Report No. 67991. The World Bank, Washington, D.C.

_____2013. "Bangladesh - Poverty Assessment: Assessing a Decade of Progress in Reducing Poverty 2000-2010." Bangladesh Development Series Paper No. 31. The World Bank, Washington, D.C.