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HOUSEHOLD INCOME DYNAMICS AND WAGE INEQUALITY IN BANGLADESH: EVIDENCE FROM HIES 2010 AND 2016

AL MAMUN [a], MD. ARFANUZZAMAN [b] AND NUSRAT JAHAN NISHAT [c]

[a] *Center for Policy and Economic Research (CPER), Bangladesh*
[b] *Food and Agriculture Organization of the United Nations (FAO), Bangladesh*
[c] *Independent University, Bangladesh*

The study used the Household Income and Expenditure Survey (HIES) data from 2010 and 2016 of Bangladesh to examine the effects of human capital (education, experience) and social factors (age, gender, location, economic activity) on income using the OLS and IV (2SLS and GMM) regression methods. The study suggests that both education and experience positively affected income in both rural and urban areas. The gender wage gap, rural-urban wage gap, and industrial and service sector wage gap all climbed to 44.1 percent, 19.4 percent, and 5 percent, respectively, in 2016, much higher than in 2010. It has emerged that both urban males and females earn significantly more than their rural counterparts in both periods. The study found a wage dominance of the service sector over the agricultural and industrial sectors in 2016. Besides, the gap between the agricultural and non-agricultural sector's wages decreased significantly in 2016, indicating decent wage growth in the agriculture sector. As both human capital and social factors have a remarkable contribution to income, strategic planning, and investment are required to reduce inequality and wage gaps and advance inclusive development in Bangladesh.

Keywords: Bangladesh, Economic Development, Gender Wage Gap, HIES 2016, Human Capital, Wage Inequality
JEL Classification: I3, J0, J3, L3, O2, R1

1. INTRODUCTION

In recent decades, Bangladesh has achieved remarkable economic growth and shown success in various socio-economic sectors, such as reductions in maternal death rates, poverty, literacy rates, development and empowerment of women, infrastructure, ICT, rural-urban linkages, and communications. The country has attained middle-income

status due to the formulation and implementation of the 7th Five Year Plan, Vision 2021, and Perspective Plan (2011-2021) in the last couple of years. The success of Vision 2021 has led the country to formulate the Perspective Plan 2021-2041 (known as Vision 2041) that aims at achieving the upper-middle-income country status for Bangladesh by 2030 and the developed country status by 2041. It is noticeable that Bangladesh's GDP grew at a record rate of 8.15 percent in FY 2018-19, which was the highest in Asia and the Pacific region. However, the COVID-19 outbreak trimmed down the growth rate to 3.51 percent in the FY 2019-20 and 5.47 percent in the FY 2020-21, which is now gearing up due to government stimulus packages, high remittance flow, good export performance, increasing agricultural production, infrastructure development, expansion of the manufacturing and service sector, and massive public expenditure.

Though Bangladesh is now at the forefront of an economic transition, several challenges, such as high unemployment, inequality, gender wage gaps, inadequate decent jobs, unguaranteed labor rights, high living costs, corruption, availability of basic needs for people with low incomes, and limited innovation and technological advancement persist to a large extent. To address such challenges holistically and sustainably, it is necessary to assess the effects of human capital, such as education and job experience, as well as relevant social factors, such as age, gender, and economic activities, on people's income. Studies suggest a robust relationship exists between education and income, and investing in education will yield a positive return (Mamun et al., 2021; Conlon and Patrignani, 2013; Shafiq, 2007). Bhutoria (2016) revealed that positive economic returns to formal education were consistently higher at the individual level, and returns varied with qualification, educational subject, age, experience, and gender. Further, Chowdhury et al. (2018), Alam (2009), and Sharif (2013) found a robust relationship between human capital development and economic growth in Bangladesh. Evidence suggests that human capital is directly associated with economic growth, and the relationship can be measured by investment in education (World Bank, 2019; Cram, 2017; Scully, 2002). Besides, a rise in human and physical capital can reduce inequality and make income distribution fairer (UN, 2016; Shahparia and Davoudi, 2014). In China, education and occupation are essential determinants of households' income in urban areas (Su and Heshmati, 2013). Men and women in the UK earn different levels of income despite having the same level of education since education has a beneficial impact on labor wages (Blundell et al., 1997). Acemoglu and Pischke (1999) suggested that in addition to education, on-the-job training increases the productivity of labor, which results in higher wages. Studies also found an insignificant relationship between income and education (Leeuwen and Foldvari, 2011; Ning, 2010), but the number of such studies is very small and can be considered an unusual case. Apart from human capital, social and spatial factors such as gender, rural-urban, and regional circumstances often cause wage inequality in many countries, which is also a matter of concern (Herrera et al., 2019; Liu et al., 2019; Waugh et al., 2016; Equitable Growth, 2018; Young, 2013).

As human capital investments are associated with sustained GDP growth and lower inequality, and social factors are associated with well-being and dignity (UN, 2019;

Saygili et al., 2018; UN, 2018; Dorset et al., 2010), Bangladesh needs a transformation in human capital development and inclusive socio-economic advancement (GED, 2021). Bangladesh's seventh and eighth five-year plans recognized the necessity of higher investments in physical and human capital to foster innovation and technological advances and promote efficient and effective productive institutions. More explicitly, the 7th five-year plan (2016-2020) puts the empowerment of people at the heart of its development strategy, as reflected in the document's subtitle: Accelerating Growth, Empowering Citizens. Considering human capital is the fundamental determinant of long-run development, the 8th five-year plan (2021-2026) also emphasized human and physical capital development, poverty reduction, innovation, and economic governance for attaining the developmental transformation that is envisioned in the Perspective Plan 2041. The National Education Policy (2010) emphasized providing appropriate education and training to a large segment of the population in rural and urban areas and expanding the coverage of technical and vocational education and ICT education. In recent years, Bangladesh has been found to have made notable advancements in educating its people, which in turn increased the literacy rate and the share of the workforce with secondary, higher secondary, and tertiary education. At this juncture, it is essential to scrutinize the effect of education and relevant social factors on household income and identify the determinants of household income for informed policymaking. As several studies examined the effects of education on income and income inequality in Bangladesh and other countries across the world, very limited studies assessed the effects of human capital (education, experience) and social factors (age, gender, location, economic activity) on income based on the national Household Income and Expenditure Survey (HIES) data, which hinders informed policy making in the areas of social welfare, human capital, and labor market development.

To bridge the current knowledge gap and generate new evidence, the study examines the HIES 2010 and 2016 with appropriate econometric methods and scientifically answers the following research question.

(i) Do determinants of income vary between HIES 2010 and HIES 2016?

(ii) How do social factors such as gender, age, marital status, rural-urban, and non-social factors (human capital) such as education and experience affect income over time?

(iii) Have human capital and social factors contributed to better income and inclusive growth in Bangladesh?

Though per capita income has increased in Bangladesh in the last few decades, income inequality, poverty, and gender wage gaps have yet to be improved. In these circumstances, the study will generate scientific knowledge and evidence on the factors affecting income and inequality over the years. This will support informed policymaking in economic sectors and the labor market, advancing fair income distribution and inclusive growth in the country.

2. METHODOLOGY AND DATA

2.1. Model Specification

The study used ordinary least squares (OLS) and two-stage least squares (2SLS) regression methods to examine the effect of human capital and social factors on household income and the generalized method of moments (GMM) to check the robustness of the results. The OLS is a standard statistical technique used in econometrics for linear models based on the mean of the conditional distribution of the regression's explained variable. However, this study considered the following extended Mincer's (1974) earning equation under Becker's (2009) framework:

$$\ln Y_i = X'_i\beta_i + u_i, \qquad i = 1, 2, 3, \cdots, n, \tag{1}$$

where Y is the monthly wage, X is the vector of predictors (set of individual characteristics),[1] and β is the slope and intercept parameters of the wage equation. The model has considered both data sets of HIES 2010 and HIES 216 separately.

The estimated OLS method has adjusted the standard error for heteroskedasticity for both data sets. Nevertheless, the regression model always has a risk of endogeneity. In the case of endogeneity, at least one of the predictors is correlated with the equation's error term through having omitted variables in the model or having measurement errors. When a regression model has an endogeneity problem, the OLS estimation becomes inconsistent and biased, and the estimator is inappropriate (Verbeek, 2008). Solving the omitted variables problem requires obtaining proxy variables correlated to the omitted variable. However, we performed Ramsey's (1969) regression specification-error test for omitted variables where the null hypothesis was rejected (the model has no omitted variables) at a 5 percent level and concluded that this study would need more variables for both HIES 2010 and 2016.

Moreover, this study has tested Davidson and MacKinnon's (1993) Durbin-Wu-Hausman endogeneity test (orthogonality conditions) to identify the existence of potential endogeneity or reverse causality in the wage equation. In 2010, the chi-square statistic was 17.95 ($p - value = 0.000$), and in 2016, the chi-square statistic was 19.532 ($p - value = 0.000$), suggesting that, for both estimations, the null hypothesis of exogenous is rejected at the 5 percent level. More specifically, there is contemporaneous endogeneity between the year of education and wage, so the OLS estimates would not be consistent with instrumental variable (IV) estimates. Therefore, Equation (1), the structural equation model, can be rewritten as follows:

$$\begin{aligned}\ln wage_i = {} & \beta_0 + \beta_1 Education_i + \beta_2 Experience_i + \beta_3 Experience_i^2 \\ & + \beta_4 Gender_i + \beta_5 MaritalStatus_i + \beta_6 Area_i \\ & + \beta_7 FieldofEconomicActivity_i + \beta_8 Occupation_i + u_i,\end{aligned} \tag{2}$$

[1] The predictors are year of education, experience, experience square, and dummy variables of gender, marital status, area, field of economic activity, and occupation.

where education is endogenous, and other variables are exogenous. Equation (2) is estimated through the two-stage least squares (2SLS) regression, a particular case of the IV method, and then the generalized method of moments (GMM) regression to check robustness. However, in the 2SLS regression, education is estimated in the first stage with parents' education variable that reflects the actual influence of education on wages. The 2SLS estimator is robust to multicollinearity and misspecification (Kennedy, 2008). The 2SLS first stage reduced form equation is as follows:

$$\begin{aligned} Education_i = {} & \delta_0 + \delta_1 ParentsEducation_i + \delta_2 Experience_i + \delta_3 Experience_i^2 \\ & + \delta_4 Gender_i + \delta_5 MaritalStatus_i + \delta_6 Area_i \\ & + \delta_7 FieldofEconomicActivity_i + \delta_8 Occupation_i + v_i. \end{aligned} \quad (3)$$

Consequently, obtain the predicted values of $\widehat{Educatıon_i}$, which contains only exogenous information, is used as an instrument in the second stage to establish the relationship. In the 2SLS second stage, the structural equation replacing an endogenous variable $Education_i$ with $\widehat{Educatıon_i}$ as follows:

$$\begin{aligned} \ln wage_i = {} & \beta_0 + \beta_1 \widehat{Educatıon_i} + \beta_2 Experience_i + \beta_3 Experience_i^2 + \beta_4 Gender_i \\ & + \beta_5 MaritalStatus_i + \beta_6 Area_i + \beta_7 FieldofEconomicActivity_i \\ & + \beta_8 Occupation_i + u_i. \end{aligned} \quad (4)$$

Furthermore, this study also uses the generalized method of moments (GMM) estimator, a consistent approach for empirically estimating IV regression (Hansen, 1982), to check the robustness of the results using Equation (3) and (4). The GMM tests how to use two sets of sample moment conditions, which can be written as $\bar{y} = \hat{\mu}$ and $\frac{[(y_1-\hat{\mu})^2+\ldots..+(y_n-\hat{\mu})^2]}{n} = 3\hat{\mu}$, in a manner that weights the two sample moment conditions to obtain an asymptotically optimal estimator (Wooldridge, 2001). The 2SLS estimates cure endogeneity in the regression model, whereas GMM addresses this issue with minimum standard error. Generally, GMM is used to gain efficiency due to neglected serial correlation and heteroskedasticity and can be used with multiple equations.

2.2. Data and Variables

This study used two sets of nationally representative HIES data (2010 and 2016) conducted by the Bangladesh Bureau of Statistics (BBS). HIES 2010 covered 55,580 individuals (Rural 35,894 and Urban 19,686) out of 12,240 households, whereas HIES 2016 covered 1,86,076 individuals (Rural 1,30,435 and Urban 55,641) out of 46,080 households. After considering only the wage earners of households, the age limit between 15 to 60,[2] and dropping all the missing values, including repeated observations

[2] Below 15 years of age has not been considered in the study as age between 5-14 years is considered child labor in Bangladesh (Salmon, 2005). Besides, household above 60 years is also not reflected in this

from the data sets, the sample size was finally reduced to 6,603 observations in HIES 2010 and 16,801 observations in HIES 2016. The final data set of HIES 2010 contains 5,912 observations of males, 691 observations of females, 3,658 observations of rural areas, and 2,947 observations of urban areas. Besides, HIES 2016 contains 16,337 observations of males, 464 observations of females, 9,671 observations of rural areas, and 7,130 observations of urban areas.

This study has considered monthly wage as the response variable and year of education, job experience, gender dummy, marital status dummy, area dummy, the field of economic activities dummy, and occupation dummy as predictors. However, this study has considered parents' education as an instrumental variable due to the endogeneity problem, then separated every earner's parents' education and omitted parents' wages from both data sets.

Table 1 illustrates the summary statistics of all the variables used in this study. The average monthly wage was BDT 5,341.97 (US$ 62.55) in 2010, which increased to BDT 11,552.40 (US$ 135.28) in 2016, more than double that of 2010. In addition, the wage difference between male-female and urban-rural also appears to be more than doubled in 2016 compared to 2010. In addition, the average year of education was 4.81 years in 2010, which increased to 7.13 years in 2016, and it also increased for male-female and rural-urban people. In both 2010 and 2016, there was no substantial difference between males' and females' education, but a significant variance was observed between rural and urban in particular years. As the study found endogeneity between the year of education and wage, it used parents' year of education as an instrumental variable, as suggested by Wooldridge (2015). Parental education also follows the same pattern as the education years. In 2010, the average experience of the earning groups was 24.58 years, which grew to 26.77 years in 2016, around two years more. The same trend was observed for male-female and rural-urban.

The 2010 HIES data suggested that 90 percent of males and 10 percent of females have participated in the job market. However, in 2016, the male participation rate increased to 97 percent, and the female participation rate declined to 3 percent, indicating the downward movement of female participation in the national workforce. Furthermore, 80 percent of respondents were married, and 20 percent were unmarried in 2010. In 2016, 98 percent of the respondents were married in the total sample, and only 2 percent were unmarried. Among the respondents, 55 percent of households worked in rural areas, and the remaining 45 percent worked in urban areas in 2010 - Besides, in 2016, the rural and urban respondents were 58 percent and 42 percent, respectively.

The labor force participation rate in the non-agriculture sector was much higher than in the agricultural sector in 2010 and 2016, regardless of gender and rural-urban areas. Further, in occupation, the service sector accommodated more than half of the employees compared to the agricultural and industrial sectors in both years, which are similar in gender and rural-urban areas.

study due to the retirement age being 59 years in Bangladesh, according to the Public Service Retirement Act 1974b.

Table 1. Summary Statistics of 2010 and 2016

	2010					2016				
	Full	**Male**	**Female**	**Rural**	**Urban**	**Full**	**Male**	**Female**	**Rural**	**Urban**
Monthly Income	5341.970 (5199.736)	5431.031 (5127.561)	4579.978 (5728.212)	4127.206 (3521.038)	6848.984 (6411.401)	11552.4 (11367.68)	11629.250 (11347.760)	8846.431 (11744.06)	9051.181 (9154.588)	14945 (13070.970)
Year of Education	4.814 (5.420)	4.800 (5.340)	4.933 (6.063)	3.455 (4.705)	6.499 (5.764)	7.127 (4.112)	7.120 (4.104)	7.371 (4.396)	6.276 (3.705)	8.280 (4.349)
F/M Year of Education	3.538 (5.136)	3.505 (5.067)	3.816 (5.690)	2.38 (4.249)	4.974 (5.744)	6.125 (3.885)	6.107 (3.873)	6.763 (4.235)	5.535 (3.517)	6.925 (4.203)
experience	24.581 (12.245)	24.715 (12.206)	23.427 (12.520)	25.824 (12.261)	23.038 (12.049)	26.771 (9.201)	26.822 (9.178)	24.976 (9.837)	27.110 (9.161)	26.312 (9.236)
Gender:										
Male	0.895 (0.306)			0.901 (0.299)	0.888 (0.315)	0.972 (0.164)	…	…	0.977 (0.151)	0.967 (0.180)
Female	0.105 (0.306)			0.099 (0.299)	0.112 (0.315)	0.028 (0.164)	…	…	0.023 (0.151)	0.033 (0.180)
Marital Status:										
Married	0.803 (0.398)	0.825 (0.380)	0.609 (0.488)	0.809 (0.393)	0.795 (0.403)	0.981 (0.137)	0.996 (0.065)	0.459 (0.499)	0.982 (0.133)	0.980 (0.141)
Unmarried and Others	0.197 (0.398)	0.175 (0.380)	0.391 (0.488)	0.191 (0.393)	0.205 (0.403)	0.019 (0.137)	0.004 (0.065)	0.541 (0.499)	0.018 (0.133)	0.020 (0.141)

Table 1. Summary Statistics of 2010 and 2016 (con't)

	2010					2016				
	Full	**Male**	**Female**	**Rural**	**Urban**	**Full**	**Male**	**Female**	**Rural**	**Urban**
Area:										
Rural	0.554	0.557	0.524			0.576	0.578	0.487		
	(0.497)	(0.497)	(0.500)			(0.494)	(0.494)	(0.500)		
Urban	0.446	0.443	0.476			0.424	0.422	0.513		
	(0.497)	(0.497)	(0.500)			(0.494)	(0.4940	(0.500)		
Field of Economic Activity:										
Agriculture	0.275	0.285	0.184	0.452	0.055	0.277	0.282	0.110	0.466	0.021
	(0.446)	(0.452)	(0.388)	(0.498)	(0.227)	(0.448)	(0.450)	(0.313)	(0.499)	(0.144)
Non-Agriculture	0.725	0.715	0.816	0.548	0.945	0.723	0.718	0.890	0.534	0.979
	(0.446)	(0.452)	(0.388)	(0.498)	(0.227)	(0.448)	(0.450)	(0.313)	(0.499)	(0.144)
Occupation:										
Service Sector	0.502	0.492	0.585	0.367	0.669	0.531	0.528	0.653	0.379	0.738
	(0.500)	(0.500)	(0.493)	(0.482)	(0.471)	(0.499)	(0.499)	(0.477)	(0.485)	(0.440)
Agricultural Sector	0.285	0.298	0.168	0.464	0.062	0.285	0.290	0.099	0.476	0.026
	(0.451)	(0.458)	(0.374)	(0.499)	(0.242)	(0.451)	(0.454)	(0.299)	(0.499)	(0.158)
Industrial Sector	0.214	0.210	0.247	0.169	0.268	0.184	0.182	0.248	0.145	0.237
	(0.410)	(0.407)	(0.432)	(0.375)	(0.443)	(0.387)	(0.386)	(0.432)	(0.352)	(0.425)
Observations	**6603**	**5912**	**691**	**3656**	**2947**	**16801**	**16337**	**464**	**9671**	**7130**

This study also examined the kernel density estimates of the logarithmic monthly wages and wage distribution by gender and area in 2010 and 2016. The two-sample Kolmogorov-Smirnov test rejects the null hypothesis, which suggests that the logarithmic daily wages for the gender and area do not come from the same distribution and, therefore, cannot be assumed to be normally distributed (the p-value is 0.000).

3. RESULT AND DISCUSSION

3.1. Estimates of OLS and IV (2SLS and GMM) Regression

Table 2 describes the major empirical results of the HIES 2010 and 2016, where the log monthly wage function was estimated for both data sets by OLS and using instrumental variable (IV) regression (2SLS and GMM).[3] According to the estimate, a year of education, one of the study's main predictors, had a positive and statistically significant effect on wages in 2010 and 2016. The coefficient of determination of the OLS and IV regressions is 0.3 in both periods. However, the reliability test of the model for both years, as already conferred, responds endogenously and has a reverse causal relationship with the monthly wage. Therefore, to address the endogeneity problem, the study used instrumental variable (IV) regression (2SLS and GMM) techniques. However, the OLS estimates show that the mean return to the additional year of education was 6.1 percent in 2010 and 5.9 percent in 2016, similar to other studies (Feigenbaum and Tan, 2020; Mamun and Arfanuzzaman, 2020). Applying the IV regression, both methods (2SLS and GMM) provide the same average return rate of 6.8 percent in 2010 and 6.8 percent in 2016, higher than the OLS estimates. The OLS and IV regressions results appear statistically significant at a 0.1 percent level in both years. Surprisingly, the estimated results of IV2SLS and IVGMM are similar in both years for each predictor.

Besides, the study indicates that job experience significantly influences monthly wages (at a 0.1 percent level). The OLS estimate suggests that an additional year of job experience caused the wage to escalate by 2.6 percent in 2010, which is 3 percent for the IV estimate. Experience appeared to have a lower influence on the wage rise in 2016 compared to 2010. The estimated coefficient of OLS and IV refers to a 2.1 percent and 2.4 percent wage increase, respectively, in 2016. The experience may have a non-linear relationship with wage; hence, this study has considered the quadratic form of experience to estimate the effect of experience more accurately. All the estimated results for both periods are negative and statistically significant at a 1 percent level. The positive effect of experience and the negative effect of experience-squared indicate that as much as the person gets to experience, the effect of experience is going to be lower. The findings of this study are similar to those of Mincer (1958) and Mamun and Arfanuzzaman (2020). They found that the person's year of education and experience affected the person's wage positively.

This study considered several dummy variables to understand the difference between groups. Here, the gender dummy shows females are remarkably earning less than males

[3] The assumption of homogeneity has tested by the Breusch-Pagan heteroscedasticity test. This study uses heteroscedasticity-robust standard errors to correct the detected heteroscedasticity. This study also tests multicollinearity and omitted-variable test by using the variance information factor (VIF) and Ramsey regression specification-error test (Ramsey RESET test) for omitted variables.

in both periods. The OLS estimates that females' wages are 38.2 percent less, and the IV estimates are 38.4 percent less than males in 2010. However, the gap was astonishingly higher in 2016, with 44.1 percent less estimated by OLS and 43.9 percent less estimated by IV regression.

Table 2. OLS and IV (2SLS and GMM) Regression of Log Monthly Wage of 2010 and 2016

	2010			2016		
	OLS	**2SLS**	**GMM**	**OLS**	**2SLS**	**GMM**
Year of Education	0.061***	0.068***	0.068***	0.059***	0.068***	0.068***
	(0.002)	(0.003)	(0.003)	(0.001)	(0.002)	(0.002)
Experience	0.026***	0.030***	0.030***	0.021***	0.024***	0.024***
	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)
Experience Square	-0.039***	-0.043***	-0.043***	-0.026***	-0.029***	-0.029***
	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)
Gender:						
Female	-0.382***	-0.384***	-0.384***	-0.441***	-0.439***	-0.439***
	(0.032)	(0.032)	(0.032)	(0.041)	(0.041)	(0.041)
Marital Status:						
Unmarried and Others	-0.079**	-0.051	-0.051	-0.188***	-0.184***	-0.184***
	(0.027)	(0.029)	(0.029)	(0.051)	(0.050)	(0.050)
Area:						
Urban	0.163***	0.153***	0.153***	0.194***	0.186***	0.186***
	(0.018)	(0.018)	(0.018)	(0.010)	(0.011)	(0.011)
Field of Economic Activity:						
Non-Agriculture	0.245***	0.236***	0.236***	0.180***	0.174***	0.174***
	(0.042)	(0.042)	(0.042)	(0.022)	(0.023)	(0.023)
Occupation:						
Agricultural Sector	0.058	0.075	0.075	-0.207***	-0.191***	-0.191***
	(0.043)	(0.043)	(0.043)	(0.022)	(0.023)	(0.023)
Industrial Sector	-0.020	-0.001	-0.001	-0.056***	-0.039***	-0.039***
	(0.021)	(0.021)	(0.021)	(0.011)	(0.012)	(0.012)
Constant	7.457***	7.355***	7.355***	8.216***	8.101***	8.101***
	(0.065)	(0.070)	(0.070)	(0.041)	(0.049)	(0.049)
N	6603	6603	6603	16801	16801	16801
R-squared	0.284	0.282	0.282	0.325	0.322	0.322
Adjusted R-squared	0.283	0.281	0.281	0.324	0.322	0.322
Root MSE	0.635	0.635	0.635	0.550	0.551	0.551

Note: Robust standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001

Besides, in 2010, the unmarried and others (including widowed/ divorced/ separated) earned 7.9 percent less than married people, as indicated by the OLS estimates. However, IV estimates are small and insignificant in this case. Compared to 2010, the gap between married and unmarried people stood more than double in 2016, with OLS estimates showing an 11 percent wage gap and IV estimates showing a 13 percent wage gap. In 2016, the OLS estimate shows unmarried and other groups earning 18.8 percent less, and the IV shows 18.4 percent less.

Usually, urban workers earn more than their rural counterparts (Asadullah, 2006). Our study found similar results (significant at a 1 percent level) by analyzing the data from 2010 and 2016. The OLS and IV estimates show that urban households earned over 16.3 and 15.3 percent more than their rural counterparts in 2010. However, as suggested by OLS estimates, the rate increased to 19.4 in 2016, a 3.1 percent higher wage than in 2010. The IV estimates indicate an 18.6 percent higher wage for urban households in 2016.

Similarly, in both periods, the wage of economic activity in the non-agricultural sector is significantly higher than in the agricultural sector. It is noticeable that the wage gap between the two sectors decreased by approximately 6 percent in 2016, indicating an increasing wage rate in the agricultural sector. Finally, the categorical variable occupation shows that agricultural households earn more, and the industrial sector earned less than the service sector in 2010. However, in 2016, the households of the agricultural and industrial sectors earned significantly less than the service sectors. Here, the agricultural and industrial sectors' wages were reduced by 20.7 percent and 5.6 percent in 2016, as suggested by OLS. However, IV estimates indicate a 3.9 percent wage reduction for the industrial sector compared to the service sector in 2016.

3.2. Estimates of Gender-Specific OLS and IV (2SLS and GMM) Regression

Table 3 illustrates that males' mean return rate on education was 5.5 percent in 2010 and 5.7 percent in 2016. Unfortunately, the gender-specific OLS estimates also suffer from endogeneity problems. To address this issue, this study applied IV (2SLS and GMM) regression techniques and found that the mean rate of return was 6.1 percent in 2010 and 6.6 percent in 2016, which is slightly higher. For females, the mean returns to education were 11.1 percent in 2010 and 11.5 percent in 2016, as suggested by OLS estimation. The IV estimate specifies that the return to education was 13.8 percent in 2010 and 13.2 percent in 2016, which is statistically significant at a 1 percent level. However, the return to an additional year of education is higher for females than males, as suggested by both OLS and IV estimates, which are more than 5 percent higher in both years. Dougherty (2005) found that women's returns to education were 1.96 percent higher than men's in the USA.

Similarly, the return to an additional year of experience on females' earnings is somewhat higher than that of males in 2010, confirmed by both OLS and IV estimates. In contrast, in 2016, experience was found to have a more significant influence on a male's income than a female's income. Here, the effect of experience on a female's

income was reduced drastically in 2016 compared to 2010. This may occur due to an increasing number of females' participation in the job market and the availability of workers at lower wages. However, the quadratic form of experience shows negative but statistically significant coefficients, which indicates that as a person gets experience, the effect of the experience is lessened. However, females' return to experience is minimal and statistically insignificant in 2016, when females earn noticeably less than males. Here, the experience squared of females shows positive coefficients, which indicates a positive effect of experiences, and a positive effect of experience squared means that as people get older, the effect is more substantial. However, using OLS and Heckman estimates, Asadullah (2006) also found that education and experience positively influence income, and females' wages are notably higher than males.

The first categorical variable, marital status, shows that in 2010, the unmarried males' wages were less than the married males', as suggested by the OLS and IV regression estimates. However, the IV estimate shows that unmarried females earn a slightly higher but insignificant wage than married females. Nevertheless, in 2016, OLS and IV estimates suggested that male and female workers earn less than their married counterparts. Here, OLS indicates that unmarried females get 25 percent less wage than married females. In contrast, urban males and females earned significantly more than their rural counterparts in 2010, and the earning rate is approximately 5 percent higher for females, as demonstrated by both OLS and IV regressions. In 2016, urban males and females earned more than their rural counterparts, and females' wages were comparatively lower than males'. Females' wages were also reduced remarkably in 2016 compared to 2010 (OLS suggests an 8 percent reduction, and GMM suggests a 5 percent reduction).

However, according to OLS and IV regression estimates, both male and female workers in the non-agriculture sector earned more than those in the agriculture sector in 2010 and 2016. Male and female workers' wages declined in 2016 compared to 2010, indicating the increasing competitiveness of the agriculture sector over time. Although male workers in the non-agriculture sector earned 26 percent more than those in the agriculture sector in 2010, their earnings had fallen to nearly 18 percent in 2016. At the same time, OLS results suggested that females' wages in the non-agriculture sector soared from 5.6 percent to 16.5 percent in 2016, which may be attributed to the rising educational level and skills of female workers in the non-agriculture sector. Males in the agriculture sector earned more in 2010 compared to the service sector, which reversed in 2016. In both 2010 and 2016, women working in agriculture received higher wages than women working in the service sector. However, the percentage of women's wages declined from 11.4 percent to 5.7 percent in 2016 compared to the service sector. The male workers in the industrial sector received lower wages in 2010 than in the service sector, which was found to be unchanged in 2016. In contrast, the wages of the industrial sector's women were higher in both periods compared to the service sector, but the ratio of women's wages declined substantially in 2016 (3 percent) compared to 2010 (17 percent) for the industrial sector.

Table 3. OLS and IV (2SLS and GMM) Regression of Log Monthly Wage for Gender of 2010 and 2016

	2010						2016					
	Male			Female			Male			Female		
	OLS	2SLS	GMM	OLS	2SLS	GMM	OLS	2SLS	GMM	OLS	2SLS	GMM
Year of Education	0.055***	0.061***	0.061***	0.111***	0.138***	0.138***	0.057***	0.066***	0.066***	0.115***	0.132***	0.132***
	(0.002)	(0.003)	(0.003)	(0.007)	(0.012)	(0.012)	(0.001)	(0.002)	(0.002)	(0.011)	(0.016)	(0.016)
Experience	0.030***	0.033***	0.033***	0.042***	0.057***	0.057***	0.023***	0.026***	0.026***	0.001	0.009	0.009
	(0.004)	(0.004)	(0.004)	(0.010)	(0.012)	(0.012)	(0.002)	(0.002)	(0.002)	(0.019)	(0.020)	(0.020)
Experience Square	-0.045***	-0.048***	-0.048***	-0.056**	-0.073***	-0.073***	-0.030***	-0.033***	-0.033***	0.032	0.024	0.024
	(0.006)	(0.006)	(0.006)	(0.020)	(0.020)	(0.020)	(0.004)	(0.004)	(0.004)	(0.035)	(0.036)	(0.036)
Marital Status:												
Unmarried and Others	-0.026	-0.004	-0.004	-0.057	0.008	0.008	-0.049	-0.042	-0.042	-0.248***	-0.247***	-0.247***
	(0.030)	(0.032)	(0.032)	(0.063)	(0.068)	(0.068)	(0.062)	(0.062)	(0.062)	(0.073)	(0.073)	(0.073)
Area:												
Urban	0.151***	0.143***	0.143***	0.226***	0.190**	0.190**	0.198***	0.190***	0.190***	0.141	0.141	0.141
	(0.019)	(0.019)	(0.019)	(0.067)	(0.067)	(0.067)	(0.010)	(0.011)	(0.011)	(0.078)	(0.077)	(0.077)
Field of Economic Activity:												
Non-Agriculture	0.262***	0.256***	0.256***	0.056	0.018	0.018	0.181***	0.174***	0.174***	0.165	0.165	0.165
	(0.042)	(0.042)	(0.042)	(0.176)	(0.181)	(0.18)	(0.022)	(0.023)	(0.023)	(0.230)	(0.224)	(0.224)
Occupation:												
Agricultural Sector	0.043	0.055	0.055	0.114	0.160	0.160	-0.211***	-0.197***	-0.197***	0.057	0.113	0.113
	(0.043)	(0.043)	(0.043)	(0.175)	(0.177)	(0.177)	(0.022)	(0.023)	(0.023)	(0.224)	(0.222)	(0.222)
Industrial Sector	-0.034	-0.021	-0.021	0.169*	0.275**	0.275**	-0.058***	-0.041***	-0.041***	0.030	0.064	0.064
	(0.022)	(0.022)	(0.022)	(0.080)	(0.087)	(0.087)	(0.011)	(0.012)	(0.012)	(0.087)	(0.092)	(0.092)
Constant	7.416***	7.338***	7.338***	6.633***	6.239***	6.239***	8.205***	8.099***	8.099***	7.472***	7.194***	7.194***
	(0.068)	(0.072)	(0.072)	(0.224)	(0.260)	(0.260)	(0.041)	(0.048)	(0.048)	(0.379)	(0.425)	(0.425)
N	5912	5912	5912	691	691	691	16337	16337	16337	464	464	464
R-squared	0.257	0.256	0.256	0.377	0.364	0.364	0.320	0.318	0.318	0.309	0.304	0.304
Adjusted R-squared	0.256	0.255	0.255	0.370	0.357	0.357	0.320	0.318	0.318	0.297	0.292	0.292
Root MSE	0.612	0.612	0.612	0.771	0.774	0.774	0.542	0.543	0.543	0.753	0.748	0.748

Note: Robust standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001

Table 4. OLS and IV (2SLS and GMM) Regression of Log Monthly Wage for Rural and Urban Areas of 2010 and 2016

	2010						2016					
	Rural			Urban			Rural			Urban		
	OLS	2SLS	GMM	OLS	2SLS	GMM	OLS	2SLS	GMM	OLS	2SLS	GMM
Year of Education	0.038***	0.042***	0.042***	0.076***	0.084***	0.084***	0.042***	0.047***	0.047***	0.076***	0.086***	0.086***
	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.002)	(0.004)	(0.004)	(0.002)	(0.003)	(0.003)
Experience	0.017***	0.019***	0.019***	0.031***	0.035***	0.035***	0.020***	0.021***	0.021***	0.021***	0.024***	0.024***
	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.003)	(0.003)	(0.003)	(0.003)	(0.005)	(0.005)
Experience Square	-0.027***	-0.029***	-0.029***	-0.045***	-0.048***	-0.048***	-0.028***	-0.030***	-0.030***	-0.020**	-0.023***	-0.023***
	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)	(0.008)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Gender:												
Female	-0.471***	-0.471***	-0.471***	-0.296***	-0.297***	-0.297***	-0.348***	-0.349***	-0.349***	-0.495***	-0.489***	-0.489***
	(0.042)	(0.042)	(0.042)	(0.048)	(0.048)	(0.048)	(0.061)	(0.061)	(0.061)	(0.056)	(0.056)	(0.056)
Marital Status:												
Unmarried and Others	-0.064	-0.053	-0.053	-0.102*	-0.069	-0.069	-0.256***	-0.255***	-0.255***	-0.131	-0.122	-0.122
	(0.035)	(0.036)	(0.036)	(0.043)	(0.045)	(0.045)	(0.069)	(0.069)	(0.069)	(0.077)	(0.076)	(0.076)
Field of Economic Activity:												
Non-Agriculture	0.296***	0.292***	0.292***	0.139	0.127	0.127	0.204***	0.200***	0.200***	0.091	0.073	0.073
	(0.044)	(0.044)	(0.044)	(0.115)	(0.115)	(0.115)	(0.023)	(0.023)	(0.023)	(0.085)	(0.086)	(0.086)
Occupation:												
Agricultural Sector	0.069	0.075	0.075	-0.078	-0.055	-0.055	-0.201***	-0.192***	-0.192***	-0.360***	-0.345***	-0.345***
	(0.046)	(0.046)	(0.046)	(0.114)	(0.114)	(0.114)	(0.023)	(0.023)	(0.023)	(0.070)	(0.071)	(0.071)
Industrial Sector	-0.012	-0.005	-0.005	-0.018	0.005	0.005	-0.030	-0.020	-0.020	-0.070***	-0.049**	-0.049**
	(0.031)	(0.032)	(0.032)	(0.028)	(0.029)	(0.029)	(0.015)	(0.017)	(0.017)	(0.015)	(0.016)	(0.016)
Constant	7.638***	7.595***	7.595***	7.545***	7.425***	7.425***	8.356***	8.292***	8.292***	8.329***	8.192***	8.192***
	(0.081)	(0.089)	(0.089)	(0.134)	(0.137)	(0.137)	(0.054)	(0.067)	(0.067)	(0.095)	(0.102)	(0.102)
N	3656	3656	3656	2947	2947	2947	9671	9671	9671	7130	7130	7130
R-squared	0.177	0.177	0.177	0.303	0.301	0.301	0.214	0.213	0.213	0.278	0.274	0.274
Adjusted R-squared	0.175	0.175	0.175	0.301	0.299	0.299	0.213	0.212	0.212	0.277	0.273	0.273
Root MSE	0.585	0.585	0.585	0.678	0.678	0.678	0.534	0.534	0.534	0.562	0.563	0.563

Note: Robust standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001

3.3. Estimates of Area-Specific OLS and IV Regression (2SLS and GMM)

Using the OLS and IV (2SLS and GMM) regressions, this work approximated the monthly income equation for rural and urban locations. Table 4 shows that in 2010 and 2016, the return to education was positive and statistically significant at the 1 percent level in rural and urban areas. Due to stronger industrialization and economic growth, the return to school in both periods is considerably higher in urban areas compared to rural areas. However, the IV estimate shows that the return to education in rural and urban areas in 2010 was 4.2 percent and 8.4 percent, respectively, with the return to education in urban areas double that in rural areas. Similarly, according to an IV estimate from 2016, the return to an extra year of education in rural areas was 4.7 percent, approximately double that in urban areas (8.6 percent). For the additional year of experience, the OLS and IV estimations produced comparable results. However, in 2010 and 2016, the quadratic experience negatively influenced income in both rural and urban areas. Furthermore, the impact of education has been determined to have increased marginally in both rural and urban areas in 2016 compared to 2010. In 2016, the effect of an additional year of experience grew in rural areas but decreased in urban areas.

Females earned significantly less than males in rural and urban areas in 2010 and 2016, according to the dummy variable gender, but the wage disparity was greater in rural areas in 2010 and urban areas in 2016. In 2010, for example, both OLS and IV regression revealed that females in rural areas earn 47 percent less than their male counterparts, and urban females earn 30 percent less than urban males. According to the OLS and IV regression, females earned 35 percent less in rural areas and nearly 50 percent less in urban areas in 2016. Furthermore, between 2010 and 2016, unmarried employees in rural and urban areas earned less than married employees.

However, OLS estimates in 2010 imply a large negative coefficient in urban areas, while OLS and IV regression in 2016 reflect higher negative coefficients in rural areas. Furthermore, in both periods, the wage of the non-agricultural sector is found to be higher in rural and urban areas. In rural areas, the wage of the non-agricultural sector was 30 percent higher in 2010 than that of the agricultural sector, which sharply decreased to about 20 percent in 2016. Mamun and Arfanuzzaman (2020) observed similar results at the mean but significantly higher wages in the non-agricultural sector in urban areas at the higher quantile. Finally, in 2010, the occupation dummy specifies that in rural areas, the wage in the agricultural sector is higher than in the service sector, and vice versa in urban areas. In rural and urban areas, the agricultural sector's wage was significantly lower than the service sector's in 2016. In 2010, the wage in the industrial sector was 1.2 percent lower and 1.8 percent lower than in the service sector. In 2016, the wage of the industrial sector was approximately 3 percent and 7 percent lower than that of the service sector.

4. CONCLUSION AND RECOMMENDATION

According to the findings, the determinants of income in HIES 2010 and HIES 2016 are largely similar and remain consistent over time. Gender, age, marital status, rural-urban status, and non-social characteristics (human capital) such as education and experience have a minor to moderate effect on income over time. The comparison of HIES 2010 and HIES 2016 using OLS and IV implies that Bangladesh's economy has experienced remarkable income dynamics. Overall, the OLS and IV (2SLS and GMM) estimates show that the return to education and experience dropped slightly in 2016, especially in contrast to 2010. The wage gap between males and females widened in 2016 compared to 2010, underlining the severity of gender inequality in Bangladesh.

On the other hand, females benefit more from an extra year of education than males, according to both OLS and IV estimates, which are more than 5 percent greater in both periods. This finding shows that investing in women's education will yield a higher return, thereby empowering women. In addition, the wage disparity between married and unmarried people and the rural-urban divide widened dramatically in 2016 compared to 2010. Furthermore, the salary gap between the agricultural and non-agricultural sectors narrowed dramatically in 2016, showing that the agriculture sector had a significant wage increase. Furthermore, this study discovered that the service sector had wage dominance over the agriculture and industrial sectors in 2016, indicating that the service sector was more productive than the other sectors.

Higher service sector wages may lure workers from agriculture and industry, reducing labor excess and increasing productivity in these industries. In 2010 and 2016, it was discovered that male and female urban workers earned much more than their rural counterparts. In addition, urban women's earnings fell marginally in 2016 compared to 2010. However, OLS and IV regression demonstrated that non-agricultural sector males and females get more excellent wages than agriculture sector males and females in 2010 and 2016. It has been observed that both male and female workers' wages decreased in 2016. The OLS and IV estimates revealed that returning to education and gaining an extra year of experience boosts income in rural and urban areas. Interestingly, the influence of education on income saw a slight increase in 2016, compared to 2010, for both rural and urban regions. The effect of experience increased in rural areas in 2016 and vice versa for urban areas. The study also suggests that females earn significantly less than males in rural and urban areas in 2010 and 2016, but the wage gap is higher in rural areas in 2010 and urban areas in 2016. Further, the non-agricultural sector's wage was 30 percent higher in rural areas compared to the agriculture sector in 2010, which sharply declined to around 20 percent in 2016. Moreover, in contrast to the service sector, the wages of the industrial sector appeared to be lower in rural and urban areas in both periods, whereas the wage gap between the industrial and service sectors was widened in 2016.

This study opens the way for a discussion of the importance of the labor market,

human capital, social factors and their effect on the structure of wages, and how investments in human capital enhance earning. It is evident from the study that human capital and social factors contributed to better income as well as inclusive growth in Bangladesh. As wage increases in urban areas, Bangladesh must focus on sustainable urbanization to accelerate national growth and intensify rural development to balance rural-urban migration. Moreover, investing in human capital, agricultural and industrial sectors productivity, gender wage gap reduction, and rural development can drive the economy's structural transformation from agrarian to manufacturing and service-based economies and advance inclusive growth, poverty, inequality reduction, and social development in Bangladesh. Nonetheless, higher investments in human capital and societal factors increase worker's productivity, resulting in positive economic growth. Bangladesh can review and adopt the strategies of Singapore, South Korea, China, Hong Kong, Taiwan, and Bangalore (India) as they successfully made their economies globally competitive by shifting from low-cost infrastructure, low labor costs, and low taxes to high value-added tech-driven industries and production system using skilled labor force, advanced strategic infrastructure and innovation. To transform the economy, Bangladesh needs to take research-based strategies to achieve higher productivity, greater capital intensity, higher levels of human capital, digitization of industries, import substitution, and a greater density of hard and soft infrastructure, which will reduce poverty, wage gaps, inequality, and improve national and household income, labor market and economic competitiveness.

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Mailing Address: Md. Arfanuzzaman, Food and Agriculture Organization of the United Nations, House #37; Road #08, Dhanmondi R/A, Dhaka-1205, Bangladesh, Email: thisisarfan@gmail.com.

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