Explaining Pro-Women Gender Wage Gap in Banglaesh

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Content

List of Tables

List of Figures

Acronyms

BBS	Bangladesh Bureau of Statistics
BDT	Bangladesh Taka
FLFP	Female Labour Force Participation
FYP	Five Year Plan
GDP	Gross Domestic Product
GoB	Government of Bangladesh
ILO	International Labour Organisation
IMR	Inverse Mills Ratio
IV	Instrumental Variable
LDC	Least Developed Countries
LFS	Labour Force Survey
MFN	Most Favoured Nation
MLFP	Male Labour Force Participation
NID	Normally Identically Distributed
NW	Nominal Wage
OLS	Ordinary Least Squares
QLFS	Quarterly Labour Force Survey
QR	Quantile Regression
RMG	Ready-made garment
RW	Real Wage
SDG	Sustainable Development Goal
USD	United States Dollar
WG	Wage Gap

1. Introduction and Motivation

Prevalence of gender wage gap is a common feature of labour markets in almost all developing countries. Earlier research using Bangladesh labour force survey (LFS) data for 1999-2000 and 2009-10 found presence of significant gender wage gap in the labour market of the country. The 2009-10 data shows that average hourly gender wage gap in Bangladesh was to the tune of about 20.0 per cent. In this backdrop the ILO report entitled 'Global Wage Report 2018/19: What lies behind gender pay gaps' has raised a lot of interest since the study, using LFS 2016-17 data, found that factor-weighted average hourly gender wage gap in Bangladesh was a reverse 4.7 per cent i.e.; average wage of women was found to be 4.7 per cent higher than that of men. Similarly, the report also found reverse median gender wage gap of 3.6 per cent for Bangladesh. The study makes an attempt to dive deep into the explanatory factors in this connection and proposes and tests alternative hypothesis in this regard.

As may be noted, the pervasive nature of gender wage gap in the labour market has been attracting increasing attention of both policymakers and development practitioners worldwide. It is argued that not only is gender wage gap not acceptable from a moral and societal point of view, reducing this gap is also important from the perspective of incentivising greater participation of women in the labour market which, in turn, will foster economic growth and promote socio-economic development. It is also to be recalled that equality between men and women has been enshrined in the constitution of Bangladesh. Article 28(1) of the constitution states: "The State shall not discriminate against any citizens on grounds of religion, race, casts, sex, or place of birth". However, whether equality in terms of wages has been achieved in Bangladesh labour market remains an issue that demands evidence-based answer. In this backdrop, the ILO study findings ought to be subjected to a closer scrutiny which is the objective of this study.

Without doubt, greater and equitable participation of women is a sign of maturity of an economy. For example, Young (1995) found that the growth miracle in South Korea owed significantly to the considerable increase in female labour force participation in the country's labour market. Similarly, Klasen and Lamanna (2009) found that a rise in female labour force participation contributes to economic growth and development in a significant way. Using simulation techniques based on the Solow (1956) growth model, Sinha (2017) estimated that if, over a five year period, there is an increase of 11.0 per cent in female labour force participation, then, on average, this will add one percentage point to Bangladesh's GDP growth for each of the subsequent years.

From an opposite perspective, research findings also indicate that gender inequality has adverse implications for growth and this could be a major hindrance to economic growth of countries (Schober & Winter-Ebmer, 2011). Rahman et al. (2018) found positive correlation between reduction in wage inequality and job creation in the Bangladesh labour market context.

In fine, there is strong research evidence that higher female labour force participation contributes not only to an inclusive development process but also to higher economic growth. Thus, both realisation of untapped potentials of women's contribution and inclusiveness of growth are factors of interest here.

Thus, it is not surprising that issues of gender based wage disparity occupy an important place in labour market discourse, both in developing and developed country contexts. However, the issues

involved are indeed complex. Some of these concern nature of labour force participation of women, employment conditions, intersectoral dimensions of wage levels and dynamics of wage growth, and the terms of labour market participation.

Major policy documents of Bangladesh including the 8FYP, Perspective Plan (Vision 2041), LDC Graduation Strategy and SDG implementation plan mention inclusivity as a key aspiration of Bangladesh in going forward. Realisation of this goal critically hinges on ensuring that increasingly more women participate in the labour market of Bangladesh, incentivised through productive and gainful employment opportunities. If greater participation of women in the labour leads to higher GDP growth and more equitable society, policy measures can be directed towards structural changes and required interventions which favour attainment of these goals. And wage is a critical ingredient and incentivising factor in this context, as evidenced by relevant literature. Exploring some of the key involved issues in this connection is the overarching objective of this research undertaking.

1.1 Background of the research

Historical data shows that world-wide rate of female labour force participation tends to be rather low. According to the aforesaid ILO study, from 1990 to 2019, the global rate of female labour force participation increased from about 50.0 per cent to only about 52.0 per cent. However, this conceals diverse spatial trends. In 2019, the female labour force participation rate was about 20.0 per cent in the Middle East and about 77.0 per cent in Sub-Saharan Africa. Women's participation rate in South Asia has indeed declined from about 35.0 per cent in 1990 to about 28.0 per cent in 2019. Women's participation in Latin America and the Caribbean had increased the most, from about 40.0 per cent in 1990 to about 52.0 per cent in 2019. In 2019, 57.0 per cent of women participated in the labour force in the United States and about 67.0 per cent in the European Union (ILO, 2018). In explaining the differences in the rate of female labour force participation in the high income and low-income countries, Cazes & Verick, (2013) and Verick, (2014) point out that in poor economies women participate in the labour force to meet the family's demand for cash, while, in contrast, in high-income economies it is the higher opportunity costs that induce women to participate in the labour force.

Globally women's contribution to GDP is estimated to be about 36.0 per cent. Women's contribution to GDP in China, Thailand, Vietnam, and Singapore is found to be higher compared to the world average. However, for Bangladesh, India, and Pakistan women's contribution to the GDP is estimated to be relatively low, at 19.0 per cent, 18.0 per cent, and 11.0 per cent, respectively.[1] In Bangladesh, for example, only about 30.0 per cent of working-age women are active in the labour force as against 80.0 per cent for their male cohorts (BBS, 2018). The lower contribution of women in the GDP of these countries underpins the need for raising participation of women in the labour force of these countries. Indeed, the issue of ensuring greater contribution of women in national GDP is a key component of the jobs agenda in the context of South Asia.[2] While it is true that women's contribution to the GDP is underestimated because of GDP estimation weaknesses,[3] greater participation of women in labour force is perceived to be a necessary factor driving the development of an economy.

[1] Accessed from https://www.economist.com/asia/2018/04/28/women-could-make-asia-rich.
[2] Available at https://www.economist.com/asia/2018/04/28/women-could-make-asia-rich.
[3] For example, women's contribution to household works that does not go through market mediation is not counted in current GDP estimation methods.

In view of the above, literature shows that in inducing women to participate in the labour force, level of earnings plays an important role. If earnings from labour market participation are not enough to help escape economic deprivations, women continue to remain trapped into the vicious cycle of poverty even when they work. This is often coined as 'working hard but working poor' (Fields, 2012). If women's employment is mainly concentrated in low paying jobs, it is difficult to overcome the challenges of widespread poverty. The related issue here is the presence of wage gap between male and female workers.

The official data for Bangladesh shows that between 2010 and 2016-17, the average monthly real wage, both for men and women, has increased by about 23.0 per cent.[4] However, the increase in real wages was not distributed evenly across different skills groups. As one moves from the least skilled to the most skilled, measured by the wages of the 5th, 50th, and 95th percentiles, the increases are about 37.0 per cent, -26.0 per cent and -5.0 per cent respectively for men, and by about 98.0 per cent, -22.0 per cent, and 12.0 per cent for the female, respectively. While, the gender wage gap between male and female labour force participants has been narrowing over time, the gap remains high for least-skilled workers, while that between moderately skilled workers has remained more or less the same.

There is a consensus among researchers regarding the prevalence of a significant gender wage gap in the labour market. Evidence testifies that the average earnings of men tend to be higher than women (Blau & Kahn, 2010, 2017). Earlier research (S. Ahmed & Maitra, 2015; S. Ahmed & McGillivray, 2015; Kapsos, 2008; M. Rahman & Al-Hasan, 2019b; Zafarullah, 2000), using labour force data from 1999-2000 to 2009-10, found a significant presence of gender wage gap in Bangladesh. Ahmed and McGillivray (2015) reported that, in 2009-10, the average hourly gender wage gap in Bangladesh was about 20.0 per cent; in other words, women were earning 20.0 per cent less than men. This finding aligned with the findings in other developing country contexts.

However, as was noted at the outset, the ILO report entitled "Global Wage Report 2018/19 – What lies behind gender pay gaps", found that factor-weighted average hourly wage in Bangladesh is 5.0 per cent more for women compared to men. This is a significant departure from the "general trend" which tend to vary between16.0 per cent and 22.0 per cent, depending on the particular methodologies used (ILO, 2018).

The results of the ILO study concerning Bangladesh (Table 1 and Table 2) are unique in the sense that out of the 64 countries in the sample, it was the only country for which factor-weighted mean gender wage gap was found to be reverse. In case of median gender wage gap as well it was almost the same (Gambia being the other exception). For all other countries, the mean and median gender wage gaps were positive. The two corresponding values for Nepal were 18.9 per cent and 6.5 per cent, for Pakistan 36.3 per cent and 41.6 per cent and for Sri Lanka these were 24.0 per cent and 23.9 per cent. This would mean that hourly factor-weighted average wage of male was found to be consistently higher than that of female labour market participants in all other countries. Also, in terms of estimated raw wage gap, Bangladesh was an outlier – with reverse mean raw wage gap of 5.5 per cent (in contrast, corresponding figures for India and Pakistan were 34.5 per cent and 34.0 per cent). These findings motivated the authors to revisit the issue, taking Bangladesh as a case study, and examine why the

[4] Nominal wage for 2016-17 was deflated using a factor 1.55 to convert the nominal wage to real wage. Subsequent reference to real wage in the paper follows the same method.

ILO results are what they are, and whether improvements in methodology of estimation of gender wage gap would produce different results. It is felt that such a study is important in view of the policy implications of the findings, and the evidential basis of the wage discourse, in the Bangladesh context.

Table 1: Summary of gender wage gap in South Asia

Countries	Raw gender wage gap (%)		Factor weighted gender wage gap (%)	
	Mean	Median	Mean	Median
Bangladesh	-5.5	0.3	-4.7	-3.6
Bhutan	N/A	N/A	N/A	N/A
India	34.5	N/A	N/A	N/A
Nepal	28.9	34.5	18.9	16.5
Pakistan	34.0	47.2	36.3	41.6
Sri Lanka	10.2	22.2	24.0	23.9
Maldives	N/A	N/A	N/A	N/A
Afghanistan	N/A	N/A	N/A	N/A

Source: Compiled from ILO (2018).

Table 2: Factor-weighted gap

Factor weighted gap	Total countries in the study: 64
Mean	Only Bangladesh has reverse gender pay gap
Median	Bangladesh and Gambia have reverse gender pay gap

Source: Compiled from ILO (2018).

The findings of the 2019 ILO study for Bangladesh is not only a significant departure from the earlier studies and overall global trends, but also appears to go against anecdotal evidence. It should be conceded, however, that cross-country study of this type needs to pursue a common methodology, which could under (over) estimate indicators when considered in specific country contexts. Nonetheless, the ILO findings call for a closer look for particularly three reasons. First, to have a deeper understanding as to why and whether the results are what they are. Second, to test out different methodologies with a view to see whether the results would be different. Third, to examine whether it is possible to arrive at a more reliable result by improving the methodology of estimation.

1.2 Outline of the study

Following the introductory section, the presentation is organised as follows. Section 2 presents the methodology of the present study with key research questions and tools to be deployed for undertaking the exercise. Section 3 provides a review of relevant literature covering various aspects of female labour force participation and gender wage gap, and techniques used to derive insights as regards gender wage gap. Section 4 presents key features of the Bangladesh labour market from gender perspectives, based on LFS data far from time points. Section 5 presents analyses of wage-gap in Bangladesh by using probit model, wage gap decomposition, and wage growth decomposition techniques. The results provide empirical evidence as regards the determinants of labour force participation, evidence of gender wage gap, and wage growth. Section 6 concludes with final observations and policy implications of the study.

2. Research Objectives and Methodology

The Bangladesh LFS 2016-17 covers 30 thousand households and 126 thousand individuals. A part of the sample respondents falls within the group of working age population, of which a part is in employment. While the sample and the labour force parameters drawn from the sample are nationally representative, it is reckoned that wage related findings based on this data should be interpreted with due care and caution. A serious lacunae of the LFS 2016-17 data is that only 5.8 per cent of the women workers in the sample have reported their wage income information. The overwhelming majority of those employed in day labour and informal sector and the self-employed did not report their wage or income. This significantly large missing wage data poses a major problem when wage-related analysis is undertaken by using the Bangladesh LFS data. Results as regards average raw wage are based on a rather small number of samples reporting wage information. Indeed, the raw gender wage gap reported by the Bangladesh Bureau of Statistics (BBS), as also found in this study, is 10 per cent (as against reverse 5.5. per cent in the ILO study, as was noted).

One gets a truncated picture when wages between male and female are compared based on raw wage data. Analytical work on raw wage and gender wage gap, while serving useful purpose, provides only a partial picture as regards the wage scenario. If underlying factors informing the wage scenario and wage gap are to be identified, one will need to dig deeper into the concerned issues by deploying factor-weighted analysis of the survey data. The ILO study has indeed done this to arrive at factor-weighted gender wage gap. The present study has also carried out a similar exercise, albeit by deploying a different methodology.

To estimate the factor-weighted gender wage gap, ILO (2018) has considered four factors: "education", "age", "working-time status" and "public-sector versus private-sector employment". Whereas "education" and "age" are in line with the human capital model, the inclusion of "working-time status" (part time of full time) and "public-sector versus private-sector employment" incorporates specific gender focus to better capture the composition effects that underlie women's and men's respective modes of participation in the labour market.

Female and male wage employees were grouped into homogeneous sub-groups, as was mentioned above. Gender pay gap in each of the sub-groups was estimated following which weighted sum of all gender-specific pay gaps, with the weights reflecting the size of each subgroup in the population, was estimated.

Following this method, the study arrives at the factor-weighted gender wage gap for Bangladesh based on 2016-17 LFS data. An important limitation of this method, however, is that if the group is not sufficiently large, inclusion of the particular factor would not affect the gender wage gap. For example, public sector in Bangladesh employs only 3.0 per cent of all employed people; overwhelming number of employees in Bangladesh is in the private sector (Bangladesh Bureau of Statistics, 2018). Hence, it is to be expected that inclusion of public-sector versus private-sector employment will have only insignificant implications for estimation results. On the other hand, about 29.0 per cent of the workers in Bangladesh work on part-time basis (Bangladesh Bureau of Statistics, 2018). So, the grouping based on work time status should be significant in terms of exploring the gender wage gap in the Bangladesh context.

If the objective of the factor-weighted gender wage gap is to provide a policy tool to reduce gender wage gap, then in case of Bangladesh, the formal-informal employment status should be considered as an important contributing factor in explaining the gender-wage divide. In the Bangladesh labour market, about 92.0 per cent of women are informal workers as against 82.0 per cent for male workers. Rahman et al. (2018) find that informality is an important cause of gender wage gap. The authors find the formal and informal wage gap in the Bangladesh labour market to be about 70.0 per cent. Thus, formal-informal employment aspects should be included in the factor-weighted gender wage gap model. As has been shown in the present study, the wage gap could change significantly if this is done. This also is indicative of why the result could differ from the ILO study could potentially differ if alternative methodology is followed.

In fine, while the factor-weighted gender wage gap is an innovative way to calculate the gender wage gap, one needs to be careful as to which variables to include in estimating the gap and which to not. Research needs to focus on country-specific characteristics of the labour market. This has been done in the present study.

A review of the ILO (2018) study indicates that the methodology used in the study suffers from a number of drawbacks.[5] To address the non-response item in the data, ILO (2018) used a "model-based framework" to predict/impute missing values. However, such predictions suffer from three problems. First, imputation reduces the variance of the imputed variables. Second, imputation reduces standard errors, which invalidates most hypothesis tests and the estimation of confidence interval. Finally, imputation does not take care of relationships between variables such as in case of correlations (Wooldridge, 2010). In view of this, for a single cross section data, it is reckoned that Heckman (1979) would be a better choice to address the missing value problem. Heckman (1974) argued that there are two groups of women in the working-age people: (a) participating in the labour force, and (b) non-participating in the labour force. The author shows that using participating women's wages to estimate the wage gap creates truncated dependent variables which results in selectivity bias in the estimates. The ILO (2018) study has used imputation method for participating women's missing wages to estimate the gender wage gap and did not consider non-participating women's wages. Second, according to the self-selection theory, women's decision to participate in the labour force is not a random selection. The choice is based on their comparative advantage and the skills they possess. The decision is not an issue of random sampling which the ILO (2018) study has assumed. It is felt that not correcting for self-selection is another drawback of the aforesaid study. Finally, the ILO (2018) study has used the quantile regression method developed by Koenker and Bassett (1978). However, the method suffers from the two shortcomings noted above.

In consideration of the limitations of the study methods noted above, the present study proposes to investigate women's wage issues in the Bangladesh context by deploying alternative tools of analyses. Such an exercise is important since it has implications for both methodology, and policy implications of the results.

Taking cue from the above discussion, the present study makes an attempt to answer a number of research questions presented below with the help of human capital theory, wage discrimination

[5]One, however, should take into cognisance that the ILO study is a global exercise. Availability of data and comparability of results had no doubt influenced the choice of the methodology used in the ILO study.

theory, and segmented labour market theory. Human capital theory emphasises that low productive workers (either male or female) occupy low-paying jobs and are unable or unwilling to obtain the necessary skills to access higher-paying jobs. On the other hand, segmented labour market theory divides jobs into two groups: i) low-paying jobs, with unstable and adverse working conditions and little room for upward mobility; ii) high-paying jobs with good working conditions and an opportunity for upward mobility. Segmented labour market theory argues that due to employers' preference, and/or non-preference, some workers (both men and women) are rationed out from higher-paid jobs. In low-paying labour markets, returns to schooling are low, workers are mostly in low-paying jobs, and there is presence of non-economic barriers which prevent the least skilled workers from moving to better-paid jobs. These theories contest the general view that labour markets can value human capital and experience adequately. These theories propose an alternative way of looking at the labour market as divided into various segments.

2.1 Research questions

The study seeks to answer the following questions in view of the above, by deploying suitable tools of analyses in the particular context of Bangladesh:

i. What are the trends and determinants of female labour force participation in Bangladesh? This question is answered based on four LFSs datasets: 1999-2000, 2005–06, 2010, and the most recent 2016–17, published by the Bangladesh Bureau of Statistics (BBS). The data from these surveys are analysed to also identify the determinants of female/male labour force participation. The study deploys a Probit model in this context.
ii. What are the historical trends in view of wage level and gender wage gap in Bangladesh? The study decomposes the data from the observed pattern of differences by using the Oaxaca-Blinder method. The study uses a version of wage gap decomposition developed by Blinder (1973) and Oaxaca (1973). [6] Chernozhukov, Fernandez-Val, and Melly (2013) came up with a framework to estimate the Oaxaca–Blinder decomposition at the conditional quantiles. The use of quantile regression to quantify the gender wage gap also allows to measure the degree of both sticky floor and *glass ceiling* in wage determination. To correct the selectivity bias in quantile regression (this is reckoned as one of the limitations of the ILO study), the study uses the methodology proposed by Arellano and Bonhomme (2017).
iii. How did the male and female workers' distribution change over time in relation to different occupations, industries and changes in human capital composition? Analysis of LFS data, and the tools mentioned in QII, have been used in this regard.
iv. What are the levels, growth and determinants of female-male wages in the Bangladesh labour market? To answer this question, the study uses methods developed by Juhn, Murphy, and Pierce (1993) which postulates that changes in wages over time come from three sources: i) changes in the distribution of individual characteristics; ii) changes in the prices of observable skills; and iii) changes in the distribution of the residuals.
v. How are wage levels determined in the Bangladesh labour market? What is the role of human capital and distribution of occupation in determining the wage structure? How do these tools help explain the wage gap in the Bangladesh context? Tools mentioned in QII above have been used to answer this question.

[6] This allows to avoid the methodological problems discussed in Oaxaca and Ransom (1994, 1999).

2.2 Data and information source

Relevant literature on theoretical and conceptual issues as also empirical evidence was reviewed extensively to draw necessary insights as regards the gender wage gaps. Data from the four LFSs of Bangladesh were analysed to answer the research questions spelt out above. It may be noted in this connection that these LFSs are nationally representative household surveys which allow undertaking of sectoral, industry level and gender-focused analyses. These are cross-section datasets having several important characteristics. First, the datasets include information on various demographic features and relevant personal characteristics attributable to working age people (the sample includes, as was noted, about 30 thousand households and 126 thousand individuals). Second, the sample size of the survey is adequate to be nationally representative. Third, the data is representative at the divisional level and is suitable for sector level analysis. Consequently, the econometric exercises carried out for purposes of the present study and the insights drawn can claim to be robust.

3. Literature Review: Wage Discrimination Theories, Limitations of Earlier Studies and Contribution of the Study

Comparisons involving raw average wage gaps serve the purpose of providing information about the state of wages on offer in the labour market but conceals the underlying heterogeneity in workers' observable and unobservable attributes. Gender wage gap in the context of developing economies can be explained more rigorously with help of various tools that deal with the factors which determine wages. Concerned theories include human capital theory, theory of gender discrimination, and segmented labour market theory. Human capital theory emphasises that low productive workers (either men or women) are stuck primarily in low paying jobs. Workers are either unable or unwilling to obtain the necessary skills to shift to jobs that pay higher wages. Drawing on this, human capital theorists postulate that poverty can be eliminated by imparting and improving the skills of labour market participants. On the other hand, segmented labour market (dual labour market) theorists divide jobs into two groups: i) low paying jobs where working conditions are not stable, working conditions are bad and there is little room for upward mobility and ii) high paying jobs with relatively good working environment and where there is an opportunity for upward mobility. Segmented labour market theorists argue that due to employers' attitude some workers are rationed out of higher-paid jobs. According to the dualistic view of the labour market, some sectors are inherently characterised by relatively low wages. Empirical evidence confirms that decent jobs offer, on average, higher wages than jobs that are not.

Dickens and Lang (1985) found two distinct labour markets with different wage-setting mechanisms. In the low paying labour market, the returns to schooling are low, workers occupy mostly low-paying jobs, and there is presence of non-economic barriers that prevent (or limit the opportunity of) the least skilled workers from accessing better jobs. A number of studies(Günther & Launov, 2012; Magnac, 1991) found supportive evidence as regards the dual nature of the labour market. These theories contest the generally accepted view that labour market properly values human capital and experience, and highlight the alternative reality of labour market segmentation.

What could be the explanation for gender wage gaps once individual characteristics have been controlled for? From the labour supply side, if individuals have different preferences for particular types

of jobs, the theory of compensating wage differentials could explain the differences in gender wage gaps across different jobs. For instance, formal jobs offer non-wage benefits that are not available in informal jobs.[7] In a frictionless market, workers with identical productivity should earn a higher wage in informal jobs to compensate for the absence of these benefits. If women value job protection more than men, they should be willing to accept lower wages compared to men in the formal sector, but not so in the informal sector. This would lead to a gender wage gap among formal sector employees. However, if women value the flexibility offered by informal jobs more than men, to better combine paid work and household responsibilities, one should expect gender wage gap among informal employees as well.

Why would employers set different wages for men and women with similar observable characteristics? Employers tend to weigh the costs and benefits of labour contract registration for both men and women and take hiring decisions and follow wage-setting practices accordingly. Given imperfect nature of information on behaviour of employees regarding labour market attachment, employers have an incentive to use information as regards typical behaviour of the demographic group to which the employee belongs (Ben Yahmed 2018). In other words, employers have an incentive to treat men and women differently because they presume that women, in general, have lower labour market attachment even when an individual man and an individual woman is equally productive on the job. For example, employers may suspect a higher quit rate among women because they are more likely to take permanent or temporary leave to have children. Lazear and Rosen (1990) provide a theoretical explanation where greater domestic responsibilities result in higher female quit rates and lower female wages due to discrimination on this ground.[8] Employment discontinuity results in higher labour costs for the firm through vacancy and replacement costs; this could also generate forgone profits if no one can replace the employee on leave or if the time out from the job causes loss of (general or specific) skills. Employers may want to compensate for the higher female quit rate by paying lower wages to women. This argument applies particularly to formal jobs where employers tend to abide by labour regulations such as job protection during maternity leave. In other words, discrimination against women would lower female wages in formal jobs where employers' costs associated with employees' job discontinuity are higher. Viewed from another perspective, women pay a penalty for their motherhood and child care, and lack of support from society to shift a part of the burden they have to bear as women.

Cross-country estimates compiled by the ILO find that, on average, women earn about 16.0 per cent to 20.0 per cent less wage than men. Blau and Kahn (2017) estimated in 2014 that annual earnings of full-time women workers are 20.0 per cent less than those of men. However, it is important to note that the average gender wage gap is found to vary across countries, and within a country, depending on regression specifications and methods used. Yukongdi and Benson (2005), using data from major Asian economies including Japan, China, India, and South Korea, found that there exists a 'managerial glass ceiling' in the labour markets of these countries.[9] Agrawal (2013) studied gender wage differentials in the rural and urban sectors of India and tested the hypothesis of relatively higher wage gap at the top of the wage distribution spectrum, as also at the bottom. The author's findings suggest that there is a *glass ceiling effect* in the rural economy and *sticky floor effect* in the urban economy of India.

[7]These could be in the form of job severance payments, maternity leave and benefits, and unemployment benefits.

[8]This is found to be the case although labour laws in most countries provide the women the right for paid maternity leave.

[9]The gap in the upper tail of the wage distribution. The result is interpreted as existence of a "glass ceiling" which prevents women from reaching high wage positions in the career ladder.

Using Indian labour market data from 1983 to 2012, Duraisamy and Duraisamy (2016) found that the male-female raw wage gap has declined over time across the wage distribution spectrum. However, the authors observe existence of sticky floor rather than glass ceiling. Adjusted wage gap in the study suggests that women at the bottom of the wage distribution face higher discrimination than those at the top. The study also found that wage gap in India has been widening at the bottom of the wage distribution over time. Channar (2010) found that in the labour market of Pakistan, women are subject to prejudice on the part of bosses and colleagues alike; often this perpetuates their remaining in the low earning groups. Some of the earlier research works carried out in Pakistan, however, did not find conclusive evidence as regards gender wage gap (and glass ceiling) (see, for instance, A. M. Ahmed & Hyder, 2008; Hyder & Reilly, 2005; Sabir & Aftab, 2007)). Using data from 1996 to 2004 for the labour market of Sri Lanka, Gunewardena et al. (2008) finds a significant presence of sticky floors but negligible presence of glass ceilings, as regards both public and private sectors.

Earlier studies on the gender wage gap in the context of the Bangladeshi labour market found a significant presence of wage gap, by deploying conditional mean regression and quantile regression. Using data for public sector workers, Zafarullah (2000) found that there is a glass ceiling in public sector jobs in Bangladesh. Kapsos (2008), based on Occupational Survey data, found that, on average, women earn about 23.0 per cent less wage per hour than men even after controlling for relevant covariates that determine wages. Ahmed and Maitra (2015), using Bangladesh labour force survey data for 2005 to 2010, carried out an Oaxaca-Blinder decomposition analysis to quantify the impact of gender discrimination on the wage gap using selectivity methods.[10] The authors found that the gender wage gap is higher in the urban economy than in the rural economy of Bangladesh. As predicted by the segmented labour market theory, the authors found different wage-setting mechanisms for men and women which allowed employers to discriminate against women. Using quantile decomposition techniques, the authors revealed the presence of sticky floor effect and gender discrimination at various points along the wage distribution spectrum.

Ahmed and McGillivray (2015) looked at the trends of gender wage gap using three Bangladesh LFS data sets.[11] The authors primarily focused on human capital theory and discrimination theory. By employing conditional mean decomposition methods based on Blinder (1973) and R. Oaxaca (1973) and unconditional quantile decomposition techniques based on Firpo et al. (2009) and Fortin et al. (2011), the authors found relatively more wide gender wage gap at the bottom of the wage distribution. In searching for reasons for the gap, the authors found that the disparity in access to higher education was the major reason driving the wage wedge. The study pointed out that without correcting for selectivity bias from the wage equations, research findings may underestimate the actual gender wage gap in the Bangladesh labour market context. Based on LFS 2005-06, Anjum (2016) deployed a variety of decomposition methods and found lower gender gap in earnings in the public sector and higher gap in the private sector. Siddiquee and Hossain (2018) decomposed wages for the urban workers using the LFS 2010 dataset and observed higher wage differences in the lower tail. Rahman and Al-Hasan (2018) found a corroboration of this for all workers using the QLFS 2015-2016 data. The authors found that due to the predominant informal nature of employment, the wage gap is larger at the lower quantiles.

[10]The study has made use of both adjusted and unadjusted methods.

[11]The three data points were for LFSs 1999-2000, 2005-6 and 2009-10.

Mahmud and Bidisha (2018) investigated the factors behind the low rate of female labour force participation in Bangladesh. The authors found that women are getting stuck in a narrow range of low-paid jobs with fewer working hours. They argued that accumulation of human capital has failed to deliver the desired results i.e., just raising human capital is found to be not very effective in getting women to participate in the labour force.

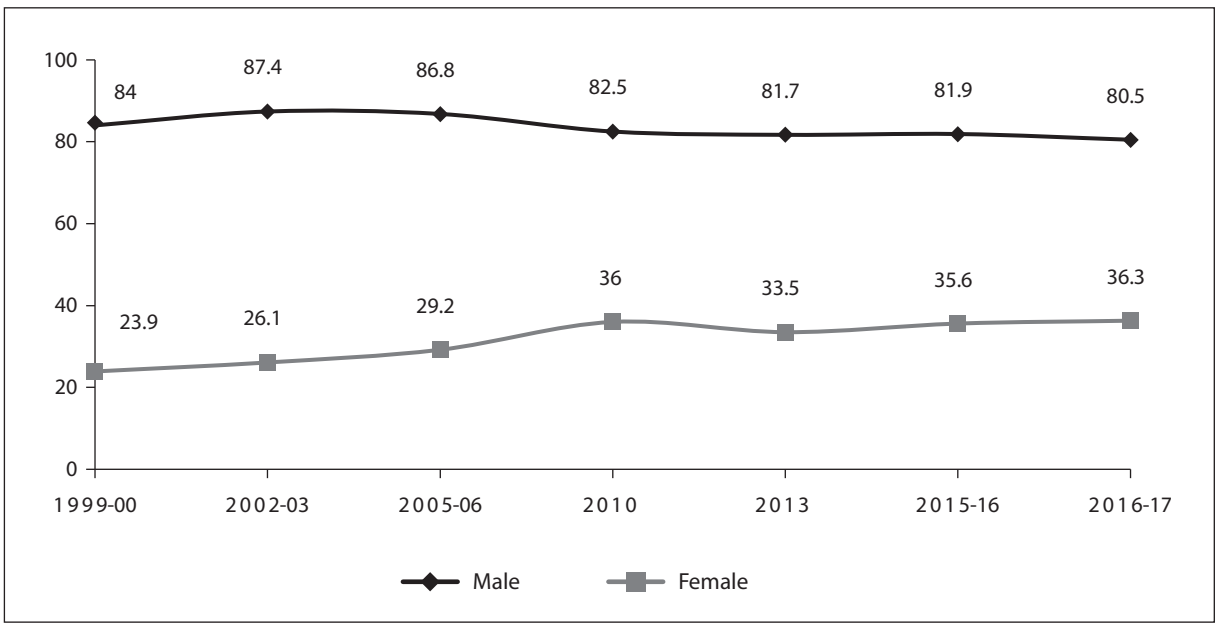
Relevant literature in the particular context of Bangladesh, however, testifies to the existence of three important research gaps. First, earlier studies did not deploy the quantile selection model which allows to have a deeper understanding of the effect of selection at the bottom and top of the wage distribution. Second, these studies have not used the quantile decomposition technique to understand the nature of wage growth of men and women using pooled cross-section data. Third, as the literature survey bears out, most studies have not considered the information in LFS 2016-17 (although the ILO study has made use of this dataset). In view of this, the proposed research will hopefully allow to glean additional insights as regards female-male wage gap in Bangladesh and be able to contribute to the relevant literature.

4. Labour and Wage Dynamics in Bangladesh

As was noted, analyses presented in the study is based on four Labour Force Surveys carried out by the BBS: 1999-2000, 2005–06, 2010, and 2016–17.

Figure 1 displays labour force participation dynamics in Bangladesh from 1999-2000 to 2016-17. Historically, the labour force participation of women in Bangladesh has been significantly lower than that of men: the rate for men and women were 80.5 per cent and 36.3 per cent respectively, as shares in the corresponding cohort of population.

Figure 1: Trends in labour force participation rates by sex, 2000-2016 (%)

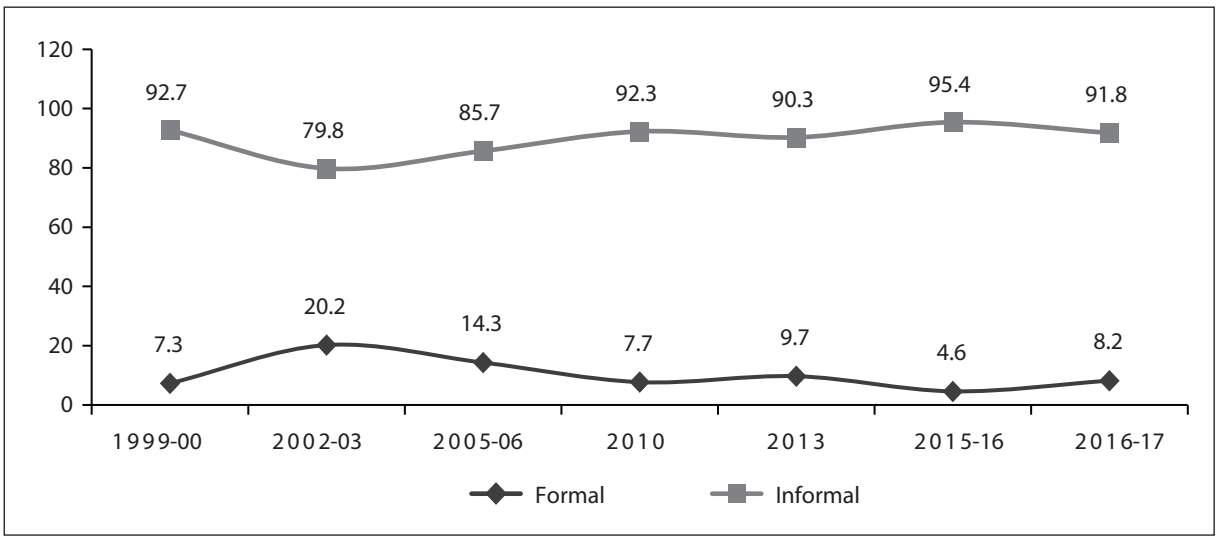


Source: Extracted from BBS, LFS (various years).

Figure 1 demonstrates that female labour force participation has experienced some rise between 1999-2000 and 2010 (from 23.9 per cent to 36.0 per cent), following which there was some decline between 2010 and 2013 (from 36.0 per cent to 33.5 per cent) with some rise thereafter (from 33.5 per cent to 36.3 per cent). On the other hand, male labour force participation has experienced some decline between 2002-03 and 2016-17 (from 87.4 per cent to 80.5 per cent). As the table testifies, the gaps in labour force participation between men and women in Bangladesh has somewhat narrowed over time. In 2002-3 the gap was 61.3 percentage points, coming down to 46.5 percentage points in 2010 and to 44.2 percentage points in 2016-17.

As in many other developing countries, informality is the dominant feature in the Bangladesh labour market. However, here also there is a gender dimension. In 2016-17, about 92.0 per cent of women were engaged in informal employment as against 82.0 per cent for men. The informal employment market is predominantly characterised by low-productive jobs (Rahman and Islam 2013). Since the share of women in informal employment is higher, this may have contributed to higher male-female wage gap. On the other hand, there may be other factors which have contributed to higher wages for women, leading to higher average wages for women when compared to men as was found in the ILO (2018) study. These hypotheses need to be tested, which has been done in the next section.

Figure 2: Share of Women's Formal-Informal Employment (%)



Source: Based on BBS, LFS (Various years) .

A detailed exposition of informality and its impact on wages in Bangladesh can be found in Rahman, Bhattacharya and Al-Hasan (2018). As suggested by dual labour market theorists, moving towards formalisation could be the key to bring down the wage gap in Bangladesh. But as subsequent analysis will indicate, this is not so straightforward and automatic.

Rising employment in the manufacturing sector is a phenomenon seen in the early stages of industrialisation in case of many developing countries. A decline in this number could be a sign of premature deindustrialisation (Rodrik, 2016). As Table 3 indicates, between 2013 and 2016-17, female employment in the Bangladesh industrial sector has come down by about 850 thousand. This is likely to have implications for gender-based wage differential.

Table 3: Employed female aged 15 years and above, by economic sectors

(in million)

Sector	2016-17	2015-16	2013
Agriculture	11.13	11.21	9.01
Industry	3.15	2.86	3.99
Service	4.37	3.70	3.85
Total	**18.65**	**17.77**	**16.85**

Source: Based on BBS (2018).

Table 4 shows the average monthly wage data for men and women in Bangladesh, for 2010 and 2016-17. Average wages for women have risen, overall and sector-wise, over the period. However, for all the three sectors (agriculture, industry and service), average wage of women was lower than those of men. The lowest difference was for the agriculture sector, while the differences for the service sector and industry sector were significant. Between 2010 and 2016-17, women's wage in the agriculture sector has remained more or less the same but experienced a rise in the other two sectors. The highest change in women's wages is seen in the service sector. In 2016-17, in the service sector, the average wage for women was found to be about 11.0 per cent higher than that of men.

Table 4: Average monthly wage by sector and gender

(in BDT)

Sector	2016-17			2010		
	Male	Female	Female as % of Male	Male	Female	Female as % of Male
Agriculture	8,309.0	8,207.0	98.7	9891.2	8,022.3	81.1
Industry	12,172.5	10,831.5	88.9	10188.9	7,006.9	68.1
Service	13,655.7	15,176.6	111.1	11060.6	7,866.5	71.1
Total	**13,583**	**12,254**	**90.2**	**10,634.4**	**7,608.7**	**71.5**

Source: Based on BBS (2018).

A decomposition of the labour force participation shows that, in 2016-2017, about 44.0 per cent of workers in Bangladesh were self-employed and about 39.0 per cent were paid employees; the remaining 16.6 per cent were either employers or unpaid family helpers, and belonged to the group of uncategorised workers (Table 5). In contrast, majority of female workers (about 68.0 per cent) are either self-employed or contributing family members.

Table 5: Status of employment by sex (%)

Status in Employment	Male	Female	Share in Labour Force	Male	Female
Employer	95.6	4.4	4.4	6.1	0.6
Own account workers	72.8	27.2	44.3	46.5	39.3
Contributing family member	24.4	75.6	11.5	4.0	28.4
Employee	75.5	24.5	39.1	42.6	31.2
Others	781	21.9	0.7	0.7	0.5
Total	**69.3**	**30.7**	**100.0**	**100.0**	**100.0**

Source: Based on BBS (2018).

As Table 6 indicates, women's share was lower than men across all the categories – except as 'contributing family members'. This pattern held both for rural and urban areas.

Table 6 also shows that, in 2010, about 27.0 per cent of all workers were engaged in top-graded jobs. Of this, about 6.0 per cent were female with the rest 21 per cent being male. However, in 2016-17, the share of workers in top graded jobs declined to only about 8.0 per cent;[12] the female share was about 2.0 per cent in this.[13] This does not augur well for the economy, as this would imply a decline in good jobs and indicates a lack of positive structural change in the economy.

Table 6: Distribution of employed population by occupation (%)

Type of Occupation	2016-17			2010		
	Male	Female	Total	Male	Female	Total
Managers	1.5%	0.2%	1.6%	2.7%	0.2%	2.9%
Professionals	3.0%	1.7%	4.7%	12.2%	4.0%	16.1%
Technicians and Associate Professionals	1.6%	0.3%	1.9%	6.4%	1.4%	7.8%
Sub-total	6.0%	2.2%	8.2%	21.3%	5.6%	26.8%
Clerical Support Work	1.2%	0.2%	1.5%	9.2%	1.0%	10.2%
Service and Sales Work	15.1%	1.5%	16.6%	13.2%	0.4%	13.6%
Skilled Agricultural,	16.6%	15.7%	32.3%	0.8%	0.1%	1.0%
Craft and Related Trade	11.9%	5.4%	17.3%	5.8%	1.0%	6.8%
Plant and Machine Operator	6.2%	0.7%	6.9%	14.7%	3.8%	18.5%
Elementary Occupation	12.4%	4.9%	17.3%	19.9%	3.3%	23.2%
Total	**69.4%**	**30.6%**	**100.0%**	**84.9%**	**15.1%**	**100.0%**

Source: Based on BBS (2018).

It is generally accepted that a shift to manufacturing jobs speak of positive structural shift in the economy. Manufacturing jobs also generally pay higher wages both for men and women. For example, in Bangladesh agriculture which contributes about 13 per cent of the GDP employs about 40 per cent of workforce. This would indicate that the productivity of labour in agriculture is thus about a-third of the national average. Table 7 shows that, in 2010, the manufacturing sector's share in total employment was about 25.0 per cent. Of this the share of male workers was about 20.0 per cent and that of female was about 5.0 per cent. In contrast, in 2016-17, the share of workers in the manufacturing sector in total employment came down to about 15.0 per cent, of which the share of male worker was about 10.0 per cent and that of female workers was about 5.0 per cent. Based on the evidence presented in Tables 3-7, one can infer that a fall in the share of male in top graded jobs and their sharp fall in manufacturing sector employment, compared to female, had an equalising implication on wages and may have contributed to reducing the gender gap in the Bangladeshi labour market.

[12]Why there has been such a drastic fall in the share, from 27.0 per cent to 8.0 per cent, needs to be investigated further given the important implications of this for the economy. However, this is outside of the purview of the present paper.

[13]Women's share was about one-third of men in both cases.

Table 7: Distribution of employed population by industry (%)

Sector Industry	2016-17			2010		
	Male	Female	Total	Male	Female	Total
Agriculture, forestry and fishing	22.3%	18.1%	40.4%	10.2%	1.6%	11.8%
Mining and quarrying	0.2%	0.0%	0.2%	0.1%	0.0%	0.1%
Manufacturing	**9.8%**	**4.8%**	**14.6%**	**19.6%**	**5.0%**	**24.6%**
Electricity, gas steam and air condition	0.2%	0.0%	0.2%	0.5%	0.1%	0.6%
Water Supply, sewerage. Waste management	0.0%	0.0%	0.0%	0.2%	0.0%	0.2%
Construction	5.3%	0.4%	5.7%	3.2%	0.6%	3.8%
Wholesale and retail trade, repair of m	13.2%	1.0%	14.3%	7.8%	0.3%	8.1%
Transportation and storage	8.4%	0.3%	8.7%	5.7%	0.1%	5.8%
Accommodation and food service activities	1.6%	0.3%	1.9%	1.0%	0.0%	1.0%
Information and Communication	0.3%	0.0%	0.3%	0.4%	0.0%	0.4%
Financial and insurance activities	0.6%	0.1%	0.7%	3.1%	0.5%	3.5%
Real estate activities	0.2%	0.0%	0.2%	0.3%	0.0%	0.3%
Professional, Scientific and Technical	0.4%	0.0%	0.5%	0.7%	0.0%	0.8%
Administrative and support service activities	0.5%	0.1%	0.6%	5.7%	0.6%	6.3%
Public administration and defense, comp	1.4%	0.2%	1.6%	9.8%	0.5%	10.2%
Education	2.1%	1.5%	3.5%	10.6%	3.9%	14.5%
Human Health and Social Work	0.5%	0.4%	0.8%	2.4%	1.2%	3.6%
Other service activities	0.1%	0.0%	0.1%			
Arts, entertainment and recreation	2.3%	1.6%	3.9%	0.2%	0.0%	0.2%
Activities of households as employers,	0.5%	1.5%	2.0%	3.7%	0.6%	4.3%
Total	**69.6%**	**30.4%**	**100.0%**	**85.1%**	**14.9%**	**100.0%**

Source: Estimated from BBS (2018).

Table 8 shows that, in 2010, about 4.0 per cent of the employed population were with tertiary education. Among the tertiary-educated workers, only 0.6 per cent were women and the rest 3.2 per cent were men. While the tertiary-educated workers' share in total workforce increased between 2010 and 2016-17, out of 5.3 per cent in the most recent LFS (2016-17) only 1.0 per cent were female. The stock of

human capital is higher for men compared to women in the Bangladesh labour market which could be a significant factor in determining gender wage differential.

Table 8: Distribution of employed population by level of education (%)

Education level	2016-17			2010		
	Male	Female	Total	Male	Female	Total
None	20.8%	11.2%	32.0%	28.4%	12.4%	40.8%
Primary	18.5%	7.4%	25.9%	16.2%	6.9%	23.0%
Secondary	21.1%	9.7%	30.9%	19.6%	9.3%	28.9%
Higher Secondary	4.7%	1.3%	6.0%	2.6%	0.8%	3.3%
Tertiary	4.3%	1.0%	5.3%	3.2%	0.6%	3.8%
Total	**69.3%**	**30.7%**	**100.0%**	**70.0%**	**30.0%**	**100.0%**

Source: Based on BBS (2018).

It is clear that women have lower human capital, and they are more into low graded jobs. But how much do they earn and what is the growth rate of their earnings? What is their level of income compared to men? Table 8 shows that the average monthly wage of men and women in the Bangladesh labour market was about BDT 13,583 and BDT 12,254 in 2016-17, respectively. This would indicate that women, on average, earn 9.8 per cent less than that of men. In 2016-17, Between 5th to 25th percentile, wage of male employees is found to be higher than that of women. Only the first percentile was an exception. By contrast, in 2010, the wage of men was higher than that of women in all the percentiles. At the median, men's earning was found to be about 14.3 per cent and 8.7 per cent higher than women in 2010 and 2016-17 respectively. At the median, the wage growth rate for men was about -26.0 per cent and that for women was about -22.0 per cent. Finally, at the 85th percentile of wage distribution, the wage growth for men was about 4.0 per cent and that for women was about 11.0 per cent. These results affirm that the decline in wage growth is consistent with other findings (see, for example, M. Rahman & Al-Hasan, 2019a). Such a pattern of wage growth would imply that there was an intertemporal equalising impact on the wage differential between men and women, as can be seen from Table 9.

Table 9: Centiles of real monthly wage (In BDT; 2010 is the base year)

Centiles	Monthly wage 2016-17		Monthly wage 2010		Growth Rate (FY2017 vs. FY2020)	
	Male	Female	Male	Female	Male	Female
1.0	2,564.1	2,564.1	1,733.3	1,516.7	47.9%	69.1%
5.0	4,166.7	3,445.5	3,033.3	1,733.3	37.4%	98.8%
15.0	4,615.4	4,166.7	4,333.3	3,033.3	6.5%	37.4%
25.0	5,128.2	4,487.2	6,066.7	3,466.7	-15.5%	29.4%
50.0	6,410.3	5,897.4	8,666.7	7,583.3	-26.0%	-22.2%
75.0	9,615.4	9,615.4	12,133.3	10,616.7	-20.8%	-9.4%
85.0	13,461.5	13,461.5	13,000.0	12,133.3	3.6%	10.9%
95.0	20,512.8	19,230.8	21,666.7	17,203.3	-5.3%	11.8%
99.0	35,256.4	27,884.6	43,333.3	17,333.3	-18.6%	60.9%
Average	13,583	12,254	10634.4	7608.7	27.7%	61.1%

Source: Based on BBS (2018).

In the backdrop of the above trends, the need for a more indepth look at gender wage gap can not be overemphasised.

5. Estimation of Gender Wage Gap

Following discussion makes an attempt to (a) explain why the ILO results are what they are, (b) to improve upon the ILO methodology to explain gender wage gap and (c) offer an alternative interpretation of gender wage gap in the Bangladesh context, by making use of different approach and methodology (details of the methodology is provided in Annex to the report).

Several steps are involved in the analysis of the causes of wage/income differences. This is hypothesised to arise because of utility maximisation. The utility maximisation is assumed here to be equivalent to wage maximisation. Since the choice between participating in the labour force and not participating in the labour force requires a discrete choice, the Roy model is considered to be an appropriate framework to analyse the underlying factors in this connection. For a detailed exposition of the methods, readers may like to see the references cited in this section. Here the discussion has been kept as brief as possible.

Selection into employment: As a first step to understand the gender wage gap, there is a need to understand how men and women are grouped into employment. Theories predict that individuals choose an occupation that maximises their utility. *A* Probit model is deployed here to estimate the probability of being in each of two mutually exclusive groups (Y_j) denoted by *j*: not in the labour force ($Y_i = 0$) and in the labour force ($Y_i = 1$). In this setting, individuals can have different probabilities of being in a given status depending on their characteristics. Also, let *Z* denote a set of conditioning variables. Both ($Z_i Y_i$) are random draws from the population.

The vector Z_i includes productive characteristics of individuals i, namely years of schooling, potential labour market experience (= *age – 6 –years of schooling*) and its square, status as household head, household size, gender dummy, religious status, marital status, children aged under six, children aged 6 to 15, live in rural area dummy, divisional dummy variables, remittance-receiving status of a household, income-generating assets of household, and presence of elder in the household.

Wage compersion methods, selection bias and solution strategy: The second step in this analysis is to estimate the gender wage gap and determinants of the gender wage gap. The raw wage gap between men and women (or any other group) is estimated from the wage equation where the dependent variable is lnw_{ij} - the log of hourly wage - is regressed on a constant and a gender status dummy (T_{ij}).

$lnw_{ij} = \beta_o + \beta \beta_1 T_{ij} + \varepsilon_{ij}$, *where* $T_{ij} = 1$ if individual *i* is female; *0* otherwise. The raw wage gap between male-female is: $E(lnw_j \mid female) - E(lnw_j \, male) = \beta_1$.

To compute the adjusted wage gap, the version of wage gap decomposition developed by Blinder (1973) and Oaxaca (1973) has been used which avoids the methodological problems discussed in Oaxaca and Ransom (1994, 1999).

However, the Oaxaca-Blinder decomposition fails to describe the full distributional impact unless the outcome variable affects both the central and the tail quantiles in the same way. Particularly since

Koenker and Bassett (1978), the Quantile Regression (QR) approach has gained acceptability in studying the effects of a covariate (*X*) on the entire distribution of the outcome variable (*Y*). Chernozhukov, Fernandez-Val, and Melly (2013) provide a framework to estimate the Oaxaca–Blinder decomposition at the conditional quantiles. The use of quantile decomposition also allows to identify the presence of a sticky floor and a glass ceiling in respect to wage.

Both in mean and quantile Oaxaca-Blinder decomposition, the characteristics vector *X* includes years of schooling, potential labour market experience and its square, religious status, marital status, lives in rural area dummy, part-time employment indicator, temporary employment indicator, public employment indicator, and informal employment indicator.

Sources of selectivity bias in wage equations: Selectivity bias in this analysis originates from two sources. First, out of 40,378 observations concerning women, one observes the wage for only 5.0 per cent of workers in the LFS (2016-17) sample (rest are missing even when they are in wage employment). Consequently, there is a sample selection bias arising from missing observations relating to wage. This particular type of problem was discussed in Heckman (1974, 1979). Second, as in the Roy (1951) model, agents self-select their occupation based on respective skills and income from occupation. This type of self-selection problem also causes a bias in econometric estimation. In the aforesaid Roy model, an agent can pursue one of two possible occupations: hunting and fishing or in respect of the present case, participate in the labour force and not participate in the labour force. Therefore, the selection is not random; rather workers self-select themselves where they can maximise their utility/wage based on their comparative advantage and skills related to the particular choice.

Identification: Heckman and Honore (1990) developed methods for identification of the Roy model. The authors consider two different cases to identify the Roy model from a single cross-section data. When econometricians have the data for one sector, as is in the case considered in this study, Heckman and Honore (1990) suggest use of exclusionary restriction to identify the wage equation and purge the selectivity bias from it. Such identification and estimation can be done using Heckman Two Step model discussed in Heckman (1974, 1979). To correct the selectivity bias in quantile regression, the methodology proposed by Arellano and Bonhomme (2017) has been used in the study.

In the selection equation, X_{1i} includes wage determinants and Z_i includes variables that determine the selection of occupation. To identify the selectivity corrected wage equation, children aged under six, children aged 6 to 15 and presence of elders in households have been used to identify the selection bias.

To examine whether excluded variables satisfy the requirement of not being correlated with wage, regression of $X \cup Z$ on the log of hourly wage has been run. It is found that excluded variables are statistically insignificant in the wage equation. Hence, these variables satisfy the requirement that these determine the selection of occupation but not wage.

Method for estimating conditional quantile wage growth: After estimating the gender wage gap, it is important to estimate the wage growth and its determinants. This allows to understand persistence of gender wage gap and why gender wage is changing. Juhn, Murphy, and Pierce (1993) (henceforth *JMP*) postulate that changes in wages over time come from three sources: i) changes in the distribution of individual

characteristics (i.e., changes in the *X's*); ii) changes in the prices of observable skills (i.e., changes in the *β's*); and iii) changes in the distribution of the residuals (i.e., changes in unmeasured prices and quantities).

Section 5.1 discusses the determinants of labour force participation of men and women in Bangladesh by using a Probit model. Here the discussion concerns the problem of selection bias, Inverse Mills Ratio (IMR), and empirical evidence of selection bias using the Heckman (1979) method. Section 5.2 presents selectivity adjusted and unadjusted gender wage gap using conditional mean (Blinder, 1973; R. Oaxaca, 1973) and quantile regression method (Arellano & Bonhomme, 2017). Finally, conditional wage growth of men and women is discussed in section 5.3 using methods developed by Juhn et al. (1993).

5.1 Determinants of male and female labour force participation

In analysing of wage gap between men and women, it is important to understand how labour force participants are selected in different occupations. This is because of the following reasons: First, it allows to understand the relationship between factors that determine both the selection of employment and wage level. Second, as was mentioned in Section 4, the wage variable suffers from self-selection bias and missing values. To correct the selectivity bias, the IMR is used. The IMR is used as an independent variable in the wage equations and is estimated from the Probit model.

Literature identifies education as a key determinant of labour force participation, both for men and women (Cazes & Verick, 2013). However, recent studies focusing on this relationship (between labour force participation and education) have discovered a U-shaped relationship in this regard (Field & Vyborny, 2016; Kanjilal-bhaduri & Pastore, 2017b; Mehrotra & Parida, 2017).

Table 10 displays the so-called U-shaped relationship between educational attainment and female labour force participation. Educational attainment of an individual has a statistically significant impact on labour force participation. However, this is not a linear relationship, rather a U-shaped one. Regression results show that women with primary, secondary, and higher secondary education have a lower probability of labour force participation compared to women with no formal education (in the probit analysis the base group for education is 'no formal education'). By contrast, women with tertiary education have a higher probability of labour force participation. The Probit results demonstrate the statistically significant presence of the U-shaped relationship between labour force participation and education for women in the overall sample for Bangladesh.

Table 10: Determinants of labour force participation

Dependent variable: Labour force participation (= 1 if participates; 0 otherwise)

Variables	(1) Full sample	(2) Male	(3) Female
Base group = No Education			
Primary Education	-0.023*** (0.003)	0.007** (0.003)	-0.085*** (0.005)
Secondary Education	-0.100*** (0.003)	-0.099*** (0.003)	-0.125*** (0.005)
Higher Secondary Education	-0.062*** (0.004)	-0.109*** (0.005)	-0.048*** (0.007)

(Table 10 contd.)

(Table 10 contd.)

Variables	(1) Full sample	(2) Male	(3) Female
Tertiary Education	0.072*** (0.005)	-0.052*** (0.005)	0.133*** (0.009)
Experience	0.018*** (0.000)	0.015*** (0.000)	0.015*** (0.000)
Experience2	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
Income generating asset index	-0.008*** (0.001)	-0.013*** (0.001)	-0.005*** (0.002)
Remittance receiving household	-0.258*** (0.004)	-0.120*** (0.004)	-0.149*** (0.006)
Ever married	-0.104*** (0.003)	0.122*** (0.004)	0.014** (0.006)
Religious	-0.019*** (0.003)	-0.013*** (0.003)	-0.028*** (0.005)
Lives in rural areas	0.075*** (0.002)	0.021*** (0.002)	0.108*** (0.003)
Household head	0.462*** (0.002)	0.085*** (0.004)	0.161*** (0.005)
Kids aged under six	-0.031*** (0.002)	0.003 (0.002)	-0.023*** (0.002)
Kids aged between 5 to 15	-0.022*** (0.001)	-0.004** (0.001)	0.004** (0.002)
Elder 80+ presence in household	0.039*** (0.006)	0.044*** (0.006)	0.052*** (0.009)
Household size	0.018*** (0.001)	0.004*** (0.001)	-0.008*** (0.001)
Observations	194,036	95,264	98,772

Notes: Average marginal effects of all covariates are computed. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

The U-shape relationship noted above indicates that poorly educated women are forced to work to survive by combining outside work with domestic duties. Among women with relatively higher education, high wages induce women to take up work. Social stigma associated with working (seen in many societies and environments) tends to disappear with higher education (Mammen & Paxson, 2000). Women who belong to the middle ground, between the two aforesaid groups, may face barriers in participating in labour force. This could arise from the absence of acute needs where moderately educated women's family income is sufficiently large so that they do not have the urgency to earn additional income to support the family. This is in contrast to education tend to have the urgency to earn cash to support family (literature defines this as income effect). There is also the issue of social stigma, noted above, associated with female employment (*social effect*) (Kanjilal-bhaduri & Pastore, 2017a; Klasen & Pieters, 2015). Women with some schooling are likely be able to get into risk-prone, low paid jobs that involve hard work in factories or enterprises. Mammen and Paxson (2000) postulate that women may dislike factory work and, if possible, avoid it. Factory work often does not pay enough to compensate for the cost of working away from home. When the education level of women rise to the tertiary level their market wages rise and together with the observed falling fertility, the cost

of participating in outside jobs decline. The benefits accruing from the combination of such factors induce women to get into labour force (Mammen & Paxson, 2000).

Some labour market experience increases the probability of sustained participation in the labour force, both for men and women. For example, as regards the full sample, it is found that an additional year of labour market experience increases the probability of labour force participation by a factor 0.018. Disaggregated regression by gender shows the coefficient to be 0.015 both for male and female; these are statistically significant at 1.0 per cent level. Family composition is found to have mixed effects. For instance, having a kid aged between zero to six years decreases the probability of labour force participation of women but raises the possibility of labour force participation for men. Married men have a higher probability to enter the labour force compared to women. It could reflect the fact that when a woman gets married, she needs to pay attention to her new family and home. Consequently, married women have a lower probability to enter into the labour force (Perry et al., 2007). If the person is a household head, probability to work rises both for men and women. In this capacity he or she feels a compulsion to work and earn money for supporting the family.

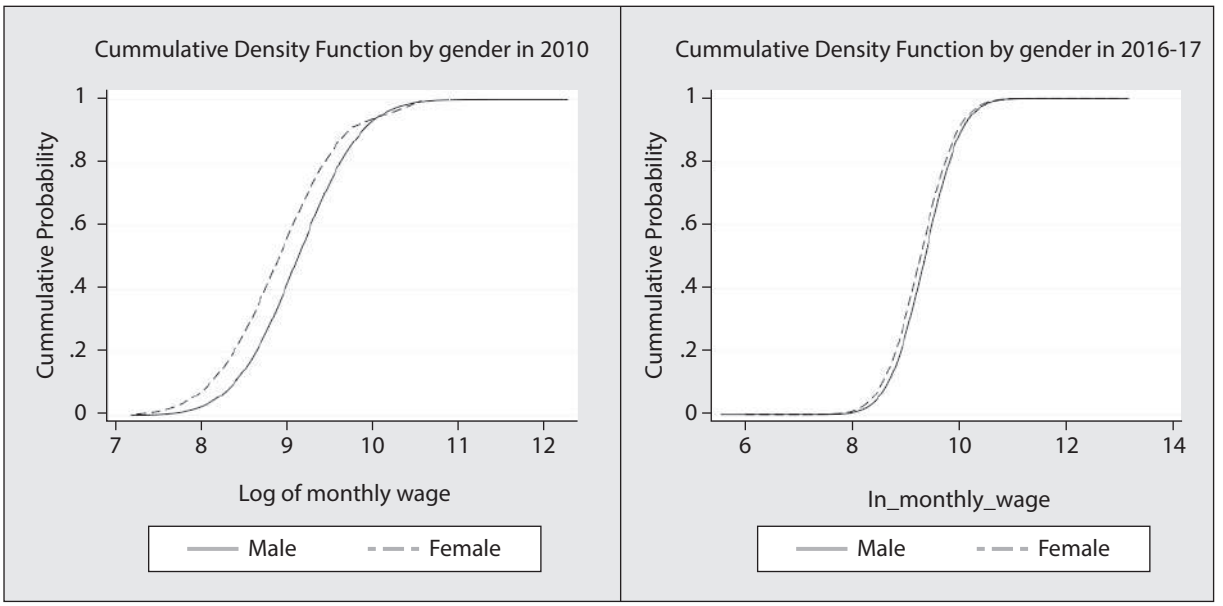
Inverse Mills Ratio (IMR): According to Heckman (1979) two-step method, a probit model is applied on variables which determine labour force participation. After running the Probit model, IMR is generated and used as a determinant of wage in the wage equation. If the IMR is statistically significant in the wage equation, one can conclude that there is a selection bias in the wage equation. Thus, it is important to note the behaviour of the IMR to understand the selection bias that can be found in the wage equation due to missing values in the wage and because of self-selection in the labour force. As was noted earlier, according to the LFS 2016-17, female labour force participation rate in Bangladesh is about 35.0 per cent, while the corresponding figure for male was over 80.0 per cent. Hence, it is highly likely that the observed wage of women may differ from the actual wage due to selectivity bias. Since bias tends to be higher with lower participation, and vice-versa, the Heckman two-step process is applied to correct the wage of women. In the estimations caried out for this study, the coefficient of IMR is found to be about 0.069 with a p-value is 0.000. In other words, the IMR indicates a statistically significant presence of selectivity bias in female wage equation due to incidental truncation in the dependent variable (i.e. wage). Consequently, a correct estimate of the gender wage gap involves getting rid of selectivity bias in the female wage equation. In the next section, both selectivity-unadjusted and selectivity-adjusted wage gaps are presented.

5.2 Econometric analysis of gender wage gap in Bangladesh labour market

Figure 3 shows the distribution function of the log of hourly wage for men and women. It is found that, both in 2010 and 2016-17, wage distribution of men stochastically dominates that of women. In other words, for every wage point, earnings are higher for male workers than those of female workers. However, it is seen from the trends that the gap between the two distribution functions has come down significantly over the corresponding period. In other words, the distribution functions confirm that the gender wage gap has indeed declined over time.

Table 11 uses OLS and median regression methods to estimate wage gaps under the human capital specification and full specification. Human capital specification uses the log of hourly wage as the dependent variable and education, potential labour market experience, and its square as dependent

Figure 3: Empirical distribution of wage by gender



Source: Computed from BBS (2018).

variables. The full specification uses human capital specification plus job-related characteristics. Using the OLS regression, ceteris paribus interpretation of the average wage gap indicates the existence of about 4.0 per cent of reverse gap under the human capital specification. By contrast, using the full specification, the ceteris paribus average wage gap is found to be about 2.0 per cent and 4.0 per cent respectively using the OLS and median regression.

Table 11: Average gender wage gap

Dependent variable: Log of hourly wage

Variables	Human capital specification	Full specification	
	OLS	OLS	Median
Female (= 1; 0 otherwise)	0.045*** (0.005)	-0.019*** (0.005)	-0.035*** (0.005)
Other variables included?	Yes	Yes	Yes
Observations	46,203	46,139	46,139
R-squared	0.35	0.46	

Source: Authors' calculation.
Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Before going into the details of wage gap analysis, it will be useful to review theories that explain the origin of wage difference. To explain the wage gap, researchers glean insights from a) segmented (dual) labour market theory and b) human capital theory. Dual market theorists argue that jobs can be divided into two groups, both for men and women: a) low wage, informal and bad working conditions driven secondary jobs, and relatively high wage, decent good working conditions dominated primary jobs. These theorists argue that primary sector jobs are rationed for least-skilled workers. Difference in job characteristics determines the difference in income distribution. Descriptive evidence in section 4 pointed out that women's representation in Bangladesh was lower in well-paid jobs (managers,

Table 12: Average wage differentials between men and women in 2017

	Wage Gap Between male and female
Controlling observables only	
Difference	0.025*** (0.007)
Explained	-0.047*** (0.005)
Unexplained	0.072*** (0.004)
Controlling observables and self-selection	
Difference	0.049*** (0.002)
Explained	0.040*** (0.002)
Unexplained	0.009*** (0.000)

Source: Authors' calculation.

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

professionals, and technicians and associate professionals). As a result, difference in wages may come from the difference in the occupational status. On the other hand, human capital theory emphasises differences among workers, rather than among jobs, as a determinant of distribution of income. According to this theory, workers in low wage jobs are inherently low productive; these workers are unable or unwilling to obtain the necessary skills to move to high paid employment. Table 8 in the preceding section shows that among the tertiary educated (5.3 per cent of labour force), 4.3 per cent are male and 1.0 per cent are female. This could be a possible determinant of the gender wage gap.

Controlling for factors that affect workers' compensation, the estimated selectivity - corrected average wage gap between men and women is found to be about 5.0 per cent in 2017; in other words, men are found to earn about 5.0 per cent more wage than women in the Bangladesh labour market. Further wage decomposition suggests that a large part of the wage gap emanates from the difference in human capital and job-related characteristics. Data shows that the average years of schooling is six years for men and that for women is five years. This difference in educational endowment accounts for about 4.0 per cent wage gap; the rest is due to the difference in job-related characteristics. Table 6 also indicates that about 6.0 per cent of the male workers do managerial or professional jobs whereas the rate is about 2.0 per cent for female. This goes on to explain that a significant difference in human capital composition and in the nature of jobs do explain the distribution of, and differences in, wages concerning men and women. Based on the evidence presented in Table 12, it may be concluded that the difference in human capital composition of men and women, to a large extent, determines the pattern of wage distribution and the consequent wage gap.

According to the dual labour market theory, there is high return to human capital (i.e. education and experience) in the primary education sector. In contrast, in the secondary sector, the returns to human capital are significantly lower than in the primary sector. It was found that about 4.0 per cent of the wage gap was on account of the difference in returns to observable characteristics (explained wage gap). Dickens and Lang (1985) argues that, in the segmented labour market, the returns to human

capital in secondary jobs is zero, and in a weakly segmented labour market, returns to human capital in the secondary jobs is significantly lower than returns to human capital in primary jobs. As a result, one observes a horizontal slope (or relatively more flat line) as regards returns to human capital for secondary jobs and an upward slope (or a much steeper slope) as regards returns to human capital in primary jobs. Estimates carried out for the present study show that returns to schooling and returns to experience are positive both for men and women but not statistically different in the full specification. Hence, returns to schooling has a similar slope. Both education and experience have an upward sloping line and share the same rate of change. This similarity in returns to productive characteristics indicates an absence of duality in the labour market (Dickens & Lang, 1985).[14]

Table 13: Quantile wage differentials between men and women in 2017

Wage Gap Between male and female			
Quantile	**Total Difference**	**Characteristics effect**	**Coefficient effect**
Controlling observables only			
$\tau = 0.15$	0.043*** (0.009)	-0.017** (0.007)	0.060*** (0.012)
$\tau = 0.50$	0.053*** (0.007)	-0.011 (0.007)	0.065*** (0.006)
$\tau = 0.85$	-0.085*** (0.014)	-0.134*** (0.019)	0.049*** (0.015)
Controlling observables and self-selection			
$\tau = 0.15$	0.063*** (0.017)	0.074*** (0.013)	-0.011 (0.016)
$\tau = 0.50$	0.012 (0.019)	0.043*** (0.016)	-0.031 (0.020)
$\tau = 0.85$	-0.115*** (0.027)	-0.082*** (0.024)	-0.033 (0.032)

Source: Authors' calculation.

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The logit distribution model has been applied. Bootstrapped standard errors with 100 repetitions are given in parenthesis.

Although Oaxaca-Blinder decomposition provides an important summary regarding the wage gap, it is not able to explain the tails of the distributions. Ahmed & McGillivray (2015) reported that the average wage gap between men and women in the Bangladesh labour market came down from 60.0 in 1999-00 to 20.0 per cent in 2010, i.e., by about 40.0 percentage points between these two time points. However, the question that arises here is whether the decline was uniform for all workers. More specifically, the wage gap declined for the average workers but one can not infer what happened to the least-skilled or most-skilled workers in the cohort. Oaxaca-Blinder decomposition can not answer this question. It could be the case that while the average gap had declined, at the tails of the wage distribution wage gap may have widened or narrowed more than the average. Quantile decomposition of the hourly wage gap could provide more additional insights in this connection.

For example, at the 15th percentile, there is about 4.0 per cent reverse hourly wage gap between men

[14]Technically, one fails to reject the hypothesis that workers with the same level of human capital composition receive different wages depending on the sector where they work.

and women. Similarly, at the median, there is a reverse gender wage gap of about 5.0 per cent. But at the 85th percentile, the wage gap is about 9.0 per cent. The wage gap at the top of the wage distribution is also indicative of the presence of a glass ceiling in the Bangladesh labour market.

At the bottom of the wage distribution, human capital and job market characteristics and the residual variation contribute to determining the wage differentials (Table 13). By contrast, at the median only residual variation determine the wage gap. Again, at the 85th percentile of the wage distribution, human capital and job market characteristics, and residual variation play a role in determining the wage differentials. The wage gap is narrowing for the least and moderately skilled workers. This is indicative of a narrowing wage gap overall. One can conclude from this that, relatively speaking, poor women are getting better wages. It is no surprise to see a higher wage gap at the top of the distribution. Distribution of workers by education level presented in Table 8 shows that about 5.0 per cent of workers were tertiary-educated in 2017, of which only 1.0 per cent are female and 4.0 per cent are male. This would indicate that at the top of the wage distribution female workers are falling behind due to a large difference in educational attainment.

5.3 Growth of real wages and its implication for wage inequality

Descriptive evidence as regards real wage growth in Bangladesh can be found in Zhang et al., (2014) where authors found that between 2000 to 2010 wages increased by over 100.0 per cent. According to the authors this was thanks to an increase in the bargaining power in negotiating wages in non-farm employment. However, the authors did not quantify the impact of the increase in bargaining power or other sources of the observed real wage growth. Results obtained by the authors did not also explain wage growth along the wage distribution spectrum. This section aims to shed light on these unanswered questions.

Table 14: Observable and unobservable components of wage change between 2010 and 2017

Real wage growth for men (A)				
Quantile	Total Change	Observed Quantities	Observed Prices	Residual Effect
τ = 0.15	-0.019 (0.016)	-0.046*** (0.005)	-0.194*** (0.019)	0.221*** (0.016)
τ = 0.50	-0.311*** (0.011)	-0.105*** (0.007)	-0.134*** (0.014)	-0.072*** (0.008)
τ = 0.85	-0.081*** (0.016)	-0.149*** (0.011)	0.054*** (0.013)	0.014 (0.013)
Real wage growth for women (B)				
Quantile	Total Change	Observed Quantities	Observed Prices	Residual Effect
τ = 0.15	0.390*** (0.036)	0.008 (0.009)	0.097* (0.051)	0.286*** (0.037)
τ = 0.50	-0.105*** (0.039)	-0.001 (0.019)	0.063 (0.039)	-0.167*** (0.020)
τ = 0.85	0.104*** (0.025)	-0.122*** (0.021)	0.284*** (0.032)	-0.058*** (0.021)

Source: Authors' calculation.

Notes: The QR method has been applied. All numbers are in percentages. Bootstrapped standard errors with 100 repetitions are given in parenthesis. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 14 quantifies the rate of real wage growth from 2010 to 2017 for men and women. Over this period, the real wage growth rate for the least skilled male was statistically zero per cent and about 40.0 per cent for the female. To quantify the contribution of the sources in wage growth, the approach developed by Juhn, Murphy, and Pierce (1993) has been used. This method breaks down the source of real wage growth rate, (Y_{it}), into three parts:

$$Y_{it} = \underbrace{X_{it}\overline{\beta}}_{i} + \underbrace{[X_{it}(\beta_t - \overline{\beta}) + F^{-1}(\theta_{it}|\boldsymbol{X}_{it})]}_{ii} + [F_t^{-1}(\theta_{it}|\boldsymbol{X}_{it}) - \bar{F}^{-1}(\theta_{it})]$$

The first part, $X_{it}\beta$ captures the effect of a change in observable characteristics (change in *X's*) at a fixed price. It is found that, for men, contribution of human capital and job market characteristics has negative impact on change in the real wage. That is, human capital in case of male workers was more productive in 2010.

The second part, $X_{it}(\beta_t - \bar{\beta}) + F^{-1}(\theta_{it} \mid X_{it})$, captures the effects of a change in skill prices of observables at fixed *X's*. The observed prices (β) positively contributed to real wage growth. At the median, it accounts for about -13.4 per cent of real wage growth for men. This implies that workers in 2017 were getting lower prices for skills. Both first and second part of the results indicate that male workers were less productive but earning more because of wage premium and market segmentation which were discussed in section 5.

Finally, the third part, $F_t^{-1}(\theta_{it} \mid X_{it}) - F^{-1}(\theta_{it} \mid X_{it})$, captures the effects of changes in the distribution of wage residuals. The effect of the residual shows a mixed contribution to wage growth throughout the wage distribution. At the 15th percentile, the residual effect is positive – about 20.0 per cent for men. For the median, the effect is negative but significant. Again, at the 85th percentile of the wage distribution, the residual impact is negative but insignificant.

For female labour force participants, the real wage growth rate is about 40.0 per cent at the 15th percentile. The effect of observed wages is statistically insignificant and the effect of residual is about 28.0 per cent. However, the effect of observed quantities is about 10.0 per cent but statistically significant at the 10.0 per cent level. The effect of the observed quantities and observed prices are statistically insignificant. So, the main reason for real wage growth is the change in residual.

Empirical evidence suggests that earnings inequality of female workers with very low skills decreases for three reasons. First, because of the observable prices for skills. This for the male workers has declined as is evidenced from 2016-17 LFS data. Second, because of the negative impact of change in the wage residual. This was indeed the case as was found in the exercise. Third, because of the positive changes in the observable values.

6. Policy Lessons and Implications of Findings

By drawing insights from the important ILO study, which is a seminal contribution to relevant literature, an attempt was made in this study to fine tune and calibrate the methodology by factoring in the particular specificities of the Bangladesh labour market. A different methodology was proposed for purposes of this particular study. This explains the departure of the findings of the present study from

the ILO study. In doing so, the study has deployed a number of tools which may help to draw deeper insights as regards the dynamics of male-female wage levels and gender-based wage gaps in the Bangladesh labour market.

Completeness of data has continued to remain a major problem in successive LFSs of Bangladesh. Presence of such high number of missing data concerning wages, as has been found in case of the LFS 2016-17, severely constrains serious and rigorous labour market research, particularly involving wage issues, and undermines reliability and accuracy of relevant analyses. Policymakers and the Bangladesh Bureau of Statistics should give highest importance and priority to generating the needed information in this regard.

The research work generated some interesting results. The analysis shows that there does exist a significant gender wage gap in the Bangladesh labour market: men do earn more than women. However, estimation of the gender wage gap tends to vary depending on the methodologies used and the regression specifications. Under the human capital specification, one observes about 4.5 per cent reverse gender wage gap in the Bangladesh labour market. This indeed closely approximates the reverse gender wage gap of 5.5. per cent found in the ILO study (2018). However, under full specification, it was found that there is a gender wage gap of about 2.0 per cent and 4.0 per cent using OLS and median regression respectively. Descriptive evidence shows that women's jobs are more concentrated in low paid low grade segment of the labour market, mostly in the informal sectors, and of informal nature. A large share of female workers are involved in agriculture sector, where labour productivity tends to remain low. Proportion of relatively more educated workers is also low among the employed women.

However, these estimates suffer from selectivity bias. Without adjusting for this, the gender wage gap tends to be underestimated. The selectivity-corrected gender wage gap in the present study is found to be about 5.0 per cent. The results indicate that, without selectivity correction, the gender wage gap will be underestimated.

Using quantile regression, it was found that there is a strong presence of glass ceiling in the Bangladesh labour market. Both the selectivity adjusted and unadjusted quantile decomposition indicate that at the top of the wage distribution the gender wage gap in Bangladesh tends to be higher. Quantile regression, using selectivity adjusted and unadjusted method, shows that at the bottom (15th percentile) and median of wage distribution, women earn about 5.0 per cent more wage than men. But at the top of the wage distribution (85th percentile) women earn about 10.0 per cent less wage than men.

The study indicates that for some type of jobs, the wage differential based on gender is relatively less of a problem in Bangladesh. It is lack of women's education (at tertiary level) and weak participation of educated women in labour market which are more of a problem. The presence of glass ceiling also appears to be the case on the ground. More opportunity should be created for women to get into higher positions by taking the advantage of higher education. While it is appreciated that the GoB policy of quota for women did play a positive role when it was in place, societal attitude to women's professional progression works as a negative factor, more prominently in the private sector. Here, as literature bears out, addressing specific issues of concern to women such as child care facilities demand particular attention.

It was mentioned at the outset that the ILO study results indicating presence of a reverse gender wage gap in the Bangladesh labour market appear to be counter-intuitive. Indeed, even among the countries in the ILO's cross-country study, Bangladesh is found to be an outlier, as was noted in the preceding section. The study hypothesis that the validity of ILO results for Bangladesh was contingent on the methodology used proved to be correct. If the (four) specifications in the ILO study are changed, the results also change and are indeed reversed as was found in the present study. However, it needs to be conceded that the ILO study covered a large number of countries for which a common methodology had to be developed. Concrete country contexts and the relative importance and significance of various possible explanatory variables could not be appropriately factored into a study covering such a large sample of countries.

The study findings have important policy implications. Evidence suggests two main reasons for the prevailing gender wage gap in Bangladesh. First, uneven participation of women across different occupations. Second, number of tertiary educated women in the labour force remains low. Third, there is a glass ceiling in the labour market. Greater participation of tertiary educated women will have two positive effects. First, as the study findings corroborate, it will reduce the gender wage gap in the labour market. Second, if the gender wage gap is reduced (and, in the end, eliminated) through greater participation of educated women, it will encourage more women, to participate in the labour market. Literature bears out that presence of gender wage gap demotivates women to participate in the labour force. Greater participation of women will create a virtuous cycle of more inclusive labour market and better wages, leading to lower inequality and more inclusive development.

In sectors such as agriculture and export-oriented activities such as readymade garments sector, participation of women is found to be higher, even though their level of education is low. Particularly in agriculture, the wages are low. In export-oriented RMG, as is known, share of women has been declining sharply over time as LFS 2013 and LFS 2016-17 data and enterprise level surveys indicate. The role of technology and structural changes in the Bangladesh economy should be carefully studied, from a gender employment perspective and through gender lens, to have a deeper knowledge as regards implications of these on the job market and wage levels and gender wage gaps.

It is reckoned that further research should be carried out along two lines. First, future research may look into the causes and consequences of stagnation of female labour force participation in Bangladesh in recent past years. Second, a large number of tertiary educated women tend to remain out of the labour market. There is a need to carry out an indepth investigation into the causes driving this trend. Addressing this is important both from the perspective of economic growth and inclusivity of economic growth in the Bangladesh context.

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Annex

Theory of Occupational Choice, Econometric Models and Estimation Methods

Several steps inform the analysis of the causes of the pattern of wage/income differences. First, the pattern of differences is hypothesized to arise out of utility maximization. We assume that utility maximization is equivalent to wage maximization. Since the choice between participating in the labour force and not participating in the labour force requires a discrete choice, the Roy model is an appropriate framework. Secondly, the observed pattern of differences is decomposed into systematic and unsystematic parts using the Oaxaca-Blinder method. Finally, the systematic part(s) of the pattern of differences is further analyzed using the procedures pioneered by Juhn, et al., (1993). For a detailed exposition of the methods, we encourage readers to see references cited in this section. Hence, we will keep this section as short as possible. These three parts are designated as 3.1), 3.2) and 3.3) in what follows.

Treatment for selection into multiple employment statuses

Theories predict that individuals choose the occupation which maximizes their utility. We use a Probit model to estimate the probability of being in each of two mutually exclusive groups (Y_i) denoted by *j*: not in the labour force ($Y_i = 0$), and in the labour force ($Y_i = 1$). In this setting, individuals can have different probabilities of being in a given status depending on their characteristics. Also, let *Z* denote a set of conditioning variables. Both, ($Z_i Y_i$) is a random draw from the population. Since, we are interested in how ceteris paribus changes in the elements of *Z* affect the response probability, $P(Y = J \mid Z),] = 0$, and *1*. Following Wooldridge (2010), the Probit model has response probabilities:

$$P(Y = J|\boldsymbol{Z}) = \frac{\exp(Z\beta_j)}{\left[1+ \sum_{h=1}^{J} \exp(Z\beta_h)\right]}, \quad (1)$$

Where β_j is $K \times 1$, J = 0, and 1. Because the response probability must sum to unity, $P(Y = 0|\boldsymbol{Z}) = 1/\left[1 + \sum_{h=1}^{J} \exp(Z\beta_h)\right]$, When J = 1, B1 is the $K \times 1$ vector of unknown parameters, and we get the binary logit model. The partial effects for the continuous Z_k can be written as: $\frac{\partial P(Y=J|Z)}{\partial Z_k} = P(Y = J|Z)\left\{\beta_{hk} - \left[\sum_{h=1}^{J} \beta_{hk} \exp(Z\beta_h)\right]/g(Z,\beta)\right\}$, where β_{hk} is the k[th] element of β_h and $g(Z,\beta) = 1 + \sum_{h=1}^{J} \exp(Z\beta_h)$.

The vector Z_i includes productive characteristics of individuals i, namely years of schooling, potential labour market experience (= *age – 6 –years of schooling*) and its square, status as household head, household size, gender dummy, religious status, marital status, children aged under six, children aged 6 to 15, live in rural area dummy, divisional dummy variables, the remittance-receiving status of a household, income-generating assets of household, and presence of elder at household.

Wage comparison methods and dealing with selection bias

The raw wage gap between men and women (or any other group) is estimated from a wage equation where the dependent variable is lnw_{ij} - the log of hourly wage - is regressed on a constant and a gender status dummy (T_{ij}).

$$lnw_{ij} = \beta_t \beta_t + \varepsilon_{ij}, \qquad (2)$$

where $T_{ij} = 1$ if individual i is female; 0 otherwise. The raw wage gap between male-female is:

$E(\ln w_j \mid \text{female}) - E(\ln w_j \mid \text{male}) = \beta_1$.

To compute the adjusted wage gap, we use a version of wage gap decomposition developed by Blinder (1973) and Oaxaca (1973) that avoids the methodological problems discussed in Oaxaca and Ransom (1994, 1999). The total wage gap in any given year can be decomposed as follow:

$$lnW_{fj} - lnW_{mj} = \underbrace{(\bar{X}'_f - \bar{X}'_m)\widehat{\beta_{lj}}}_{i} + \underbrace{\bar{X}'_f(\hat{\beta}_{fj} - \hat{\beta}_{lj}) + \bar{X}'_m(\hat{\beta}_{lj} - \hat{\beta}_{mj})}_{ii} \qquad (3)$$

The first part on the right-hand side accounts for the wage difference because of different characteristics (it's called endowment effects). The second part of the equation accounts for the wage differential arising from differences in the observed prices associated with given characteristics (both terms together called the coefficient effect).

The Oaxaca-Blinder decomposition fails to describe the full distributional impact unless the outcome variable affects both the central and the tail quantiles the same way. Since Koenker and Bassett (1978) the Quantile Regression (QR) approach has become relatively popular to study the effects of a covariate (X) on the entire distribution of the outcome variable (Y). More concretely, we can specify the τ^{th} quantile of the conditional distribution of Y_i given X_i as a linear function of the covariates, $Q_\tau(Y_i \mid X_i) = X_i\beta_i$, $\tau \varepsilon (0,1)$. Chernozhukov, Fernandez-Val, and Melly (2013) provide a framework to estimate the Oaxaca–Blinder decomposition at the conditional quantiles. Given the wage (W) and job market characteristics (X), and the conditional distribution function $F_{w_f \mid w_f}$ and $F_{w_m \mid w_m}$ describe the stochastic assignment of wages to workers with characteristics X for female and male respectively. Let $F_{Y(f \mid f)} = \int F_{Yf \mid Xf)}(y \mid x)\, dF_{Xf}(x)$ and $F_{Y(m \mid m)} = \int F_{Ym \mid Xm)}(y \mid x)\, dF_{Xm}(x)$ represent the observed distribution function of wages for men and women, and let $F_{Y(m \mid f)} = \int F_{Yf \mid Xf)}(y \mid x)\, dF_{Xm}(x)$ be the counterfactual distribution function of wage that would have prevailed for male had they faced the female wage schedule $F_{w_f \mid w_f}$.

The difference in the observed wage distribution between men and women can be decomposed in the spirit of the Oaxaca–Blinder decomposition at the τ^{th} quantile as follows:

$$F_{\mathrm{W(f|f)}}(\tau) - F_{\mathrm{W(m|m)}}(\tau) = \underbrace{F_{\mathrm{W(f|f)}}(\tau) - F_{\mathrm{W(f|m)}}(\tau)}_{i} + \underbrace{F_{\mathrm{W(m|f)}}(\tau) - F_{\mathrm{W(m|m)}}(\tau)}_{ii} \qquad (4)$$

where first and second part of equation 4 has a similar interpretation of equation 3. Chernozhukov, Fernandez-Val, and Melly (2013) argues that linear quantile regression is only flexible if outcome variable

(wage) has a smooth conditional density, and this method may provide a poor approximation to the conditional distribution when wage has mass points. They proposed the use of a logit distribution regression to address associated methodological problems discussed and cited in Chernozhukov, Fernandez-Val, and Melly (2013).

Both in mean and quantile Oaxaca-Blinder decomposition the characteristics vector *X* includes years of schooling, potential labour market experience and its square, religious status, marital status, lives in rural area dummy, part-time employment indicator, temporary employment indicator, public employment indicator, and informal employment indicator.

Sources of selectivity bias in wage equations: The selectivity bias in this analysis is coming from two sources. First, out of 40,378 observations of women, we observe the wage of only 5.0 per cent of workers, and we do not observe wage of any unpaid family workers. Therefore, we have a sample selection bias arising from missing observation in the wage. This particular type of problem was discussed in Heckman (1974, 1979). Second, as in Roy (1951) model, agents self-select their occupation based on their skills and income from occupation. This type of self-selection problem also causes a bias in econometric estimation. In the Roy (1951) model, an agent can pursue one of two possible occupations: hunting and fishing or in our case participate in the labour force and not participate in the labour force. Therefore, the selection is not random rather workers self-select themself where they can maximise their utility/ wage based on their comparative advantage and skills related to that particular choice.

Identification: Heckman and Honore (1990) proposed methods for the identification of the Roy model. They consider two different cases to identify the Roy model from a single cross-section data. When the econometrician has data for one sector, as is in our case, Heckman and Honore (1990) proposed to use exclusionary restriction to identify the wage equation and purge the selectivity bias from it. Such identification and estimation can be done using Heckman Two Step model discussed in Heckman (1974, 1979).

Finally, to correct the selectivity bias in quantile regression methodologies proposed by Arellano and Bonhomme (2017) have been used.

In the selection equation, X_{1i} includes wage determinants and Z_i includes variables that determine the selection of occupation. To identify the selectivity corrected wage equation we are using children aged under six, children aged 6 to 15, presence of elders at household to identify the selection bias.

To check that the excluded variables satisfy the requirement that they are uncorrelated with wage, we run a regression of $X \cup Z$ on the log of hourly wage. We find that excluded variables are statistically insignificant in the wage equation. Hence, these variables satisfy the requirement that they determine the selection of occupation but do not determine wage (see, Table 9).

Decomposition of differences in the wage distribution

Juhn, Murphy, and Pierce (1993) (henceforth *JMP*) proposed that changes in wages over time come from three sources: i) changes in the distribution of individual characteristics (i.e., changes in the *X's*); ii) changes in the prices of observable skills (i.e., changes in the *β's*); iii) changes in the distribution of the

residuals (i.e., changes in unmeasured prices and quantities). They define β to be the average prices for observables over the whole period and $\bar{F}(.|X_{it})$ to be the average cumulative distribution. Equipped with the above assumptions and definitions they decompose the level of wage changes into three components:

$$Y_{it} = \underbrace{X_{it}\beta}_{i} + \underbrace{[X_{it}(\beta_t - \beta) + F^{-1}(\sigma_{it}|\Lambda_{it})]}_{ii} + \underbrace{[F_t^{-1}(\sigma_{it}|\Lambda_{it}) - F^{-1}(\sigma_{it}|\Lambda_{it})]}_{iii} \qquad (5)$$

The Y_{it} is calculated from the raw data and it is the difference of wages between two groups. In equation 5, first term captures the effect of a change in observable characteristics distribution at fixed prices, the second term captures the effects of changing skill prices for observables at fixed *X's*, and the third term captures the effects of changes in the distribution of wage residuals.

Juhn, Murphy, and Pierce (1993) is an extension of Oaxaca-Blinder decomposition that takes into account the distribution of residuals. This decomposition does not account for heteroscedasticity. In the original paper, JMP formally allows for the distribution of residuals to depend on the covariates. If the error term is Normally Identically Distributed (NID), this procedure is efficient. However, the error term is rarely NID. Hence, this research relies on Melly (2005) to account the heteroskedasticity.

Gender wage gap in the labour market is a widely discussed issue in relevant discourse and literature. Societal attitude, occupational segregation, vertical segregation, barriers to entry and retention, and discriminatory practices at workplace are often cited as factors contributing to women getting lower wages compared to men. However, the ILO publication titled "Global Wage Report 2018/19: What lies behind gender pay gaps" singles out Bangladesh as an outlier where women's average wages, both raw and factor-adjusted, were found to be higher than those of men. These counter-intuitive findings have raised a lot of interest and queries as regards the underlying causes leading to these results. The present study undertakes a thorough investigation of the methodology deployed by the ILO study and critically examines the factors contributing to the reverse gender gap as found in case of Bangladesh. Using alternative methods and tools of analysis, the study finds, contrary to the ILO findings, that in terms of raw (non-adjusted) as also factor-adjusted wages, women in Bangladesh, on average, earn less than those of men. The study argues that while for the same type and level of job gender-based wage discrimination is not found to be significant, there does exist a glass ceiling in the Bangladesh labour market resulting in lower share of women in higher paying jobs. The study offers suggestions to improve methods of gender wage gap estimation, and recommends policy initiatives towards greater participation of women in the Bangladesh labour force and for creating better opportunities for women in higher paying jobs in the Bangladesh labour market.

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