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The Effect of Gender Inequality in Education, Labor Force Participation and Economic Opportunity on the Income Distribution of India

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Abstract

This study analyzes the degree of gender inequality in education, labor force participation, and economic opportunity and its relationship with income distribution in India. The study aims to discern if a negative relationship exists between gender inequality in the multi-dimensional context and income distribution. Certain studies prove that gender wage inequality and income distribution exhibit a positive correlation for export-oriented economies wherein women provide most of the labor for the export sector. However, it is not the same case for gender inequality in the education and labor force. The theoretical model is based on Becker's net earnings model but adjustments are done to the variables used. Using annual time-series data provided by the World Bank, World Inequality Database, and Human Development Report, the researchers assume that gender inequality in wages, mean and expected years of schooling, and labor force participation rate affects income distribution across the top, middle, and bottom classes in India. In addressing this issue, the purpose of the study is to form policy recommendations to reduce inequalities in gender across India's education and economic sector.

Keywords: *Gender Inequality, Education, Labor Force Participation, Income Distribution*

Introduction

Gender inequality has been an ongoing societal problem for India, a multifaceted issue evident across health, education, economic, and political sectors. As gender discrimination increases over time in India, the country struggles in closing its gender gap. This can be seen in the 2020 Global Gender Gap Report by the World Economic Forum. India ranks 112th out of 153 countries, an unfortunate declined from its 2018 ranking of 108th on the country's performance on gender equality. It has been observed that economic opportunity is not the same between men and women, as women in India experience discrimination in both education and economic sectors due to different factors such as social and cultural practices. This economic barrier puts women at a disadvantage emphasizing the need for policy development that will remove or reduce the inequalities.

Gender inequality remained to be the main concern as it continues to rise despite achieving progress in recent years (Sumanjeet, 2017). Many Indian women in history were oppressed, challenged, and neglected (Amutha, 2017). However, the Indian government provided policies to equalize the rights of men and women to boost women's participation and remove the

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traditional patriarchal norms that affect women's status in the household and workplace like the Equal Remuneration, the Minimum Wages, and the Prohibition of Child Marriage enforced to put an end to gender inequalities. Nevertheless, more reforms are needed as gender bias remains prevalent in education, labor force participation (LFP), and wages. Dhar (2018) affirmed that the government attempts to eliminate gender inequality. The initiatives taken are patterned with the United Nations Sustainable Development Goal 5, which aims to achieve gender equality and improve women empowerment. However, majority of these women are still experiencing gender discrimination, which makes it more difficult for them to access resources, benefits, and opportunities (Amutha, 2017).

Son preference, early marriage, domestic violence, and lack of investment are caused by religious, demographic, socio-cultural, and economic factors (Bose, 2012; Edwards, 2017), as these affect the distribution of wages and lessens the economic opportunities available for individuals. In 2019, the female labor force participation rate (LFPR) was lower than the male LFPR. Baliyan and Sinha (2014) discussed the factors behind women's low LFP such as the limited control and ownership of resources, uneven working conditions, and uneven distribution of resources for household consumption. Mukherjee and Majumder (2011) revealed that gender inequality affects the earning differentials among variegated spatial and socio-economic groups of workers in India. Gender wage inequality in India is classified into two: occupational segregation and direct discrimination (UNDP, 2006).

Bertay et al. (2020) mentioned that gender equality ensures fairness women, resulting in higher productivity and improved economic performance at the industry level. However, gender inequality in education, LFP, and economic opportunities is widespread in the Indian labor market against women (Bose, 2012; Edwards, 2017; Roychowdhury & Mukhopadhyay, 2018). Education gap against women undoubtedly affect both LFP and gender wage gap (Mohapatra and Luckert, 2014). Gender wage gap is primarily attributed to education, ethnicity, economic sectors, and geographic areas (Vo et al., 2019). Hence, it is essential to conduct gender analyses to identify gender-based differences and relationship with income distribution at the country level. The study highlights the multi-dimensional context of gender discrimination existing in India. Specifically, the severity of gender discrimination in several dimensions which include the education and economic sector and its overall relationship with the top, middle, and bottom class.

Method

This study used a quantitative research design to provide a statistical analysis of the multi-dimensional context of gender inequality and its effect on income inequality from 1998 to 2019 annual data collected to determine the causal factors associated with income distribution in India. Income distribution is measured based on pre-tax national income of three income classes, specifically top 10 percent shares, middle 40 percent shares, and bottom 50 percent shares. The education index obtained from the HDI of the UNDP Human Development Report. Second, LFP is measured in terms of the LFPR of individuals within the age range of 15 to 64 years old derived from the World Bank Database. Third, the gender pay gap expressed in terms of the percentage of wage salaried workers sourced from the India Wage Report published by the ILO. This is with the study of Kuhn and Ravazzini (2017) which examined women's LFP and household inequality. The model used in the study employed household income as a dependent variable while LFPR and wages as the independent variable. It has been shown that an increase in female LFP affects income inequality in various ways such as

inequality in women's earnings, women's share of the total household, and the relation of women's earnings relative to men. Similarly, Baloch et al. (2018) explored the connection between gender inequality and income inequality and analyzed the effects of gender inequality on income distribution, and employed the Gini coefficient in measuring income distribution while the global gender gap index data was utilized to capture the gender gap in educational attainment and economic participation. However, the measurement for income distribution would be different as this study used the percentage shares of pre-tax national income instead of the Gini coefficient due to its unavailability of sufficient data.

The model used in this study to indicate the general relationship between gender inequality in the multi-dimensional context and income distribution in India is presented as follows:

$$Income\ distribution = \beta_0 + \beta_1 gender\ inequality\ in\ education + \beta_2 gender\ gap\ LFP + \beta_3 gender\ pay\ gap + e \quad \text{(Eq. 1)}$$

The dependent variable used in this study is measured using the percentage shares of pre-tax national income (income distribution) in India. The data was based on the pre-tax national income share of three income classes: top, middle, and bottom. The measure is based on a population of individuals over the age of 20 while an individual is the base unit of the data but the resources are split in an equal manner among spouses. Annual time series data were collected from the World Inequality Database providing the analysis of tax data from the Indian Tax Department and NSSO Survey data. Pre-tax national income is computed by adding the pre-tax labor income (comprising the total ranking of pre-tax income) and pre-tax capital income (expressed in the total ranking of pre-tax income). Depending on the income class of pre-tax national income, the signs for each independent variable may be different.

Stationarity Test

Most economic time series data have unit roots which show that their means and variances are not time-invariant. If this is the case, a univariate series is said to be non-stationarity and cannot be used for regression with other non-stationary univariate series because of the risk that their results may be spurious. The only exception to this rule is when the time series data of all variables have identical unit roots. The widely used unit root test is the so-called Augmented Dickey-Fuller test, the equation is as follows:

$$\Delta x = \alpha_o + \alpha_1 t + \beta x_{t-i} + \Sigma\varphi \Delta x_{t-i} + \varepsilon_t \quad \text{(Eq. 2)}$$

Where the first difference of the series, Δx_t, is regressed against lagged of its original level series, time, and lagged values of itself. If the estimated value of β is more negative than the MacKinnon critical values, the series is said to be stationary. Otherwise, it is non-stationary and therefore has a unit root.

An efficient test in determining the optimal lag length is to minimize the Akaike Information Criterion (AIC) for each lag length on a trial-and-error basis. For the AIC which is a popular test, the formula is as follows:

$$ln\ AIC = (2k/n) + ln\ (RSS/n) \quad \text{(Eq. 3)}$$

Where k is the number of regressors including intercept, n is the number of observations, and RSS is the regression sum of squares. After experimenting with a sufficient number of lags in the model, the one which produces the smallest AIC would indicate the appropriate or optimal lag length.

Cointegration Test

The cointegration test used to determine the stability and probability of a long-run relationship between the explanatory variables and a dependent variable. With the aim of this study, the test will contribute to identifying the degree or severity of gender inequality across education, labor force, and wages in income distribution using annual time series data. If the computed *trace statistics* and *maximum-eigenvalue statistics* exceed their critical values, then there is cointegration among the variables. The hypothesized relationships cannot be deemed spurious and therefore genuine equilibrium relationships existed.

Heteroskedasticity Test

If the variance of the regression residuals of the model is time-varying, the parameters and their standard errors are said to be biased and inefficient. This condition is known as heteroskedasticity and if uncorrected could lead to wrong conclusions and decisions on the part of the investigator. To detect the presence of heteroskedastic disturbances in the residuals, the White Heteroskedasticity Test will be used.

$$u^2 = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \alpha_4 X_1^2 + \alpha_5 X_2^2 + \alpha_6 X_3^2 + \alpha_7 X_1 X_3 + \alpha_8 X_2 X_3 + v_t \quad \text{(Eq. 4)}$$

Where u^2 is the squared regression residuals regressed against the explanatory variables, their squares, and cross products. The test will be able to identify the presence of heteroskedasticity, signifying that there are outliers that are relatively small or large observations compared to other observations in the sample. Omission of the variables is also a factor that contributes to heteroskedasticity. This test will determine whether the variance of regression errors is determined by the values of the independent variables.

Structural Stability Test

Structural stability test refers to the stability of the coefficients of a regression model between different periods. In this study, such a test will be performed using the Chow Breakpoint Test. A structural change could mean a change in the intercept, a change in the slope coefficients, or a change in both the intercept and slope coefficients. Either way, the results would imply structural instability in the model, therefore, cannot be used for policy analysis and forecasting.

The formula for testing the structural stability of the regression parameter involving time series data is as follows:

$$F = \frac{\left(RSS_R - RSS_{UR}\right)/k}{RSS_{UR}/\left(n_1 + n_2 - 2k\right)} \quad \text{(Eq. 5)}$$

Where k is the number of regressors including intercept, n is the number of observations, RSS_R is the regression sum of squares restricted, and RSS_{UR} is the regression sum of squares unrestricted. If the computed F-statistic exceeds the critical value, there is structural instability. Otherwise, the model is said to be structurally stable.

Specification Error Test

The Ramsey Regression Equation Specification Error Test will be used to test the impact of non-linear combinations of the independent variables presented in data values in providing an accurate explanation of the dependent variable, across time series data. The application of squared and cubed terms in the regression model will help determine the number of functions of independent variables and misspecification of errors in the model will also be tested.

A Specification error test is associated with the specification of the model regarding the inclusion of an irrelevant variable, the exclusion of relevant variable, or the functional form of the model. A Specification error creates biased or inconsistent regression estimators, and the inconsistency can still be there even when the sample observation increases. This study used the equation:

$$\hat{Y}_i = \hat{\beta}_1 + \hat{\beta}_2 X_{2i} + \hat{\beta}_3 X_{3i} + \gamma \hat{Y}_i^2 \quad \text{(Eq. 6)}$$

Results and Discussion

Table 1 shows that gender gap LFP, gender pay gap, pre-tax national income bottom, middle and top are all stationary at the second difference, while gender inequality in education is stationary at first difference. Table 2 shows that there is cointegration among the variables. The results correspond to the findings of several studies (Azam, 2012; Chamarbagwala, 2010; Garcias and Kassouf, 2021; Deshpande et al., 2018; Lahiri-Dutt and Pattnaik, 2020; Raveendran, 2016; Daymard, 2015; Deyshappriya, 2017; Picchio and Mussida, 2011; Mohanty, 2021; Vo et al., 2019; Yamamoto et al., 2019; Mohapatra and Luckert, 2014; Othman, 2015; Adams and Sarkodie, 2020; Kuhn and Ravazzini, 2017). Cointegration exists between the variables gender inequality in education and gender pay gap as shown in some studies (Azam, 2012; Chamarbagwala, 2010) and revealed that women with higher education received higher wages at the top of the wage distribution as higher number of years of schooling corresponds to higher earnings for women (Garcias and Kassouf, 2021). However, Deshpande et al. (2018) revealed that education does not have an overlying effect on the increase in wages for women due to other economic factors such as the sticky floor effect and glass ceiling.

Various studies coincide with the results of the cointegration test between gender inequality in education and gender gap LFP. Studies (Lahiri-Dutt and Pattnaik, 2020; Raveendran, 2016) showed that the fluctuating women's LFPR in India is driven by education as general human capital positively affects women's LFP (Daymard, 2015). Moreover, gender gap LFP and gender pay gap exhibited a significant relationship. Similarly, Picchio and Mussida (2011) stated that gender inequalities in economic activity affect wage distribution. Additionally, Mohanty (2021) revealed that employed women especially those working in the technical industry suffer from inequalities in the wage distribution. Education and economic activity contributed to inequalities in the wage distribution (Vo et al., 2019). Similarly, Othman (2015) stated that wage inequality persists even when women and men have equal access to education and employment opportunities. Moreover, unequal employment opportunities and low wages suffered by Indian women are the factors behind parents' hesitant behavior in providing their daughters' education (Yamamoto et al., 2019; Mohapatra & Luckert, 2015).

Table 1. Unit root test

Variable	Level	Prob	First Difference	Prob	Second Difference	Prob
Gender Gap LFP	-2.294746	0.1805	-1.656690	0.4414	-4.907646	0.0005***
Gender inequality in education	-1.061961	0.7163	-3.578129	0.0130**	-5.817700	0.0001***
Gender Pay Gap	1.594764	0.9991	-1.812571	0.3664	-3.858513	0.0090***
Pre-tax national income Bottom 50%	-0.902064	0.7712	-2.238218	0.1981	-5.319479	0.0002***
Pre-tax national income Middle 40%	-0.858412	0.7850	-2.364061	0.1605	-5.501195	0.0001***
Pre-tax national income Top 10%	-0.855259	0.7860	-2.329211	0.1703	-5.444443	0.0001***

Table 2. Cointegration test

Hypothesized No. of CE(s)	Trace Statistic	Prob.	Max-Eigen Statistic	Prob.
None *	149.4709	0.0000***	49.18210	0.0036***
At most 1 *	100.2888	0.0000***	41.32539	0.0054***
At most 2 *	58.96343	0.0032***	26.62474	0.0660*
At most 3 *	32.33869	0.0250***	16.47182	0.1985
At most 4 *	15.86687	0.0439**	14.96008	0.0388**
At most 5	0.906796	0.3410	0.906796	0.3410

Table 3 shows that all variables significant to pre-tax top national income. Gender inequalities in LFP increased income inequality among top-income earners (Kuhn and Ravazzini, 2017; Baloch et al., 2018). Moreover, gender pay gap has a positive effect on pre-tax top national income, while both gender inequality in education and gender gap LFP has a negative effect on pre-tax top national income. Several studies (Sudo, 2017; Vo et al., 2019; Weaver et al., 2015; Hunt, 2015) exhibited significant relationship between gender pay gap and income distribution. Contrary to Sudo (2017), Weaver et al. (2015), and Hunt (2015) showed that female engineers and physicians, considered top income earners, receive lower pay than men of the same work expertise. Deyshappriya (2017) and Adams and Sarkodie (2020) revealed that limited access to education and employment opportunities in developing countries leads to inequalities in income distribution across the top, middle-, and bottom-income earners. Table 3 also shows that there is normality in the estimation results, there is no serial correlation error and there is no heteroskedasticity. However, results show that there is a structural breakpoint in the results. Moreover, there is no specification error at 1% alpha.

Table 3. Estimation Results for Top Income Class

Dependent Variable: Pre-Tax National Income Top 10% Sample: 1998 2019					
Variable	Coefficient	Std. Error	t-Statistic	Prob.	VIF
Constant	-0.249784	0.085009	-2.938344	0.0088	NA
Gender Pay Gap	0.006308	0.001279	4.932791	0.0001	5.076832
Gender inequality in education	-0.108474	0.009296	-11.66914	0.0000	2.268417
Gender Gap LFP	-0.013673	0.001465	-9.333620	0.0000	3.250635
R2	0.989062				
F-statistic	542.5601				
Prob(F-statistic)	0.000000				
Jarque-Bera Stat	4.476662				
Prob(Jarque-Bera Stat)	0.106636				

	F-statistic	Prob.
Breusch-Godfrey Serial Correlation LM Test:	1.362442	0.2592
Heteroskedasticity Test: ARCH	0.148682	0.7041
Heteroskedasticity Test: Breusch-Pagan-Godfrey	1.073049	0.3854
Chow Breakpoint Test:	47.93327	0.0000
Ramsey RESET Test	5.114444	0.0371

Table 4 shows that all variables are significant to pre-tax top national income for the middle-income class. The widespread gender inequality in education, biased towards men, puts women at a great disadvantage in terms of labor opportunities, which eventually translates into lower pay compared to their male counterparts. Similarly, Mohapatra and Luckert (2014) demonstrated that education gap resulting from the discrimination against women will undoubtedly affect both LFP and the gender wage gap. Findings of this study revealed that the distributional effect of primary education is significantly favorable towards

women in the median wage distribution. Furthermore, Garbinti et al. (2018) showed that gender inequality in LFP and gender pay gap is significant to pre-tax top national income for the middle class. Evidence showed that the persistent reduction of gender inequality in labor income can be explained by the substantial growth in women's LFP.

Gender pay gap has a negative effect on pre-tax top national income, while both gender inequality in education and gender gap LFP has a positive effect on pre-tax top national income for the middle-income class as supported by various studies (Vasina & Sloka, 2019; Chinara & Mitali, 2018; Mohanty, 2021), thus promote income inequality in the workforce, especially in the Indian labor market where women workers greatly experiencing discrimination. Specifically, Deshpande et al. (2018) showed that regular salaried women, considered middle-income earners, still earn less compared to their male counterparts even though they have higher educational attainment than men. Parent's low motivation to educate their daughters, especially in less developed countries, is influenced by a significant wage differential and women labor market opportunities being less favorable than men (Yamamoto et al., 2019). Furthermore, Deyshappriya (2017) asserted that an increased in education and LFP would substantially reduce income inequality in Asian countries. Table 4 also shows that there is normality in the estimation results, there is no serial correlation error and there is no heteroskedasticity. However, results show that there is a structural breakpoint. Moreover, there is no specification error at 1% alpha.

Table 4. Estimation Results for Middle Income Class

Dependent Variable: Pre-Tax National Income Middle 40%					
Sample: 1998 2019					
Variable	Coefficient	Std. Error	t-Statistic	Prob.	VIF
Constant	0.850591	0.055469	15.33455	0.0000	NA
Gender Pay Gap	-0.004423	0.000834	-5.300718	0.0000	5.076832
Gender inequality in education	0.069739	0.006066	11.49734	0.0000	2.268417
Gender Gap LFP	0.009251	0.000956	9.677950	0.0000	3.250635
R2	0.989632				
F-statistic	572.6777				
Prob(F-statistic)	0.000000				
Jarque-Bera Stat	3.788293				
Prob(Jarque-Bera Stat)	0.150447				
		F-statistic			Prob.
Breusch-Godfrey Serial Correlation LM Test:		1.334648			0.2640
Heteroskedasticity Test: ARCH		0.170552			0.6842
Heteroskedasticity Test: Breusch-Pagan-Godfrey		1.037225			0.3999
Chow Breakpoint Test:		44.63331			0.0000
Ramsey RESET Test		5.075307			0.0378

Table 5 shows that gender pay gap, gender inequality in education, and gender gap LFP are all significant to pre-tax top national income for the lower-income class. Inequality in the gender pay gap is significantly higher at the top and bottom quantile of the wage distribution, which specifies that low-paid and high-paid wage earners are more exposed to extreme inequalities (Vo et al., 2019). Bose (2012) and Jayachandran (2015) showed that gender inequality in education due to socio-cultural factors is found to have a significant and widening effect in gender gaps present in developing countries. Azam (2012) and Chamarbagwala (2010) mentioned that educational returns for women are relatively lower at the bottom of the wage distribution, compared to the top of the wage distribution. Furthermore, Picchio and

Mussida (2011) illustrated that the gender wage gap is observable in the labor market and is increasing largely at the lower end of the wage scale.

Gender pay gap has a negative effect on pre-tax top national income, while both gender inequality in education and gender gap LFP has a positive effect on pre-tax top national income for the lower-income class, which is similar to estimation results for the middle-income class. Consistently, Vasina and Sloka (2019), Chinara and Mitali (2018) and Mohanty (2021) showed that gender pay gap have a negative relationship with income equality, as an increase in the gender pay gap between men and women promotes income inequality in the workforce. This may be explained by Vasina and Sloka (2019) that Indian women from poor households, who have no access to primary education, are presumed to have the highest women's LFP as their primary source of income to survive from daily expenses. These women provide an equalizing effect to income distribution. On the contrary, Duraisamy and Duraisamy (2016) claimed that gender inequality in education and LFP has a positive effect on pre-tax top national income as it reveals the widespread discrimination in the Indian labor market which results in women, including illiterate women are seen to be working in low-productivity jobs with lower pay. Table 4 also shows that there is normality in the estimation results, there is no serial correlation error and there is no heteroskedasticity. However, results show that there is a structural breakpoint in the results. Moreover, there is no specification error at 1% alpha.

Table 5. Estimation Results for Lower-Income Class

Dependent Variable: Pre-Tax National Income Bottom 50% Sample: 1998 2019					
Variable	Coefficient	Std. Error	t-Statistic	Prob.	VIF
Constant	0.399350	0.029636	13.47520	0.0000	NA
Gender Pay Gap	-0.001882	0.000446	-4.220976	0.0005	5.076832
Gender inequality in education	0.038720	0.003241	11.94777	0.0000	2.268417
Gender Gap LFP	0.004425	0.000511	8.664495	0.0000	3.250635
R2	0.987785				
F-statistic	485.2150				
Prob(F-statistic)	0.000000				
Jarque-Bera Stat	6.046306				
Prob(Jarque-Bera Stat)	0.048648				
		F-statistic		Prob.	
Breusch-Godfrey Serial Correlation LM Test:		1.447496		0.2454	
Heteroskedasticity Test: ARCH		0.108258		0.7457	
Heteroskedasticity Test: Breusch-Pagan-Godfrey		1.157800		0.3531	
Chow Breakpoint Test:		53.37705		0.0000	
Ramsey RESET Test		5.171459		0.0362	

Conclusion

This study analyzed the effect of gender inequality in wage, education, and LFP on the income distribution of India. Findings showed that there is an existing relationship between wage, education, and LFP, emphasizing the importance of the right to education as it influences wage distribution and creates job opportunities. Several previous studies have highlighted gender inequality in the labor market negatively affects economic growth. However, the study affirmed that the relationship between gender inequality in wage, education, labor force, and income distribution could vary based on their income class.

Findings show that for the top income class, the gender pay gap has a positive effect on the pre-tax national income while gender inequality in both education and LFP has a negative effect on the pre-tax national income. Low-cost female labor and gender wage discrimination may boost export-led growth in semi-developed countries, which is a concerning issue from an equitable perspective (Schober & Winter-Ebmer, 2011). However, demographic factors such as education and LFP could significantly contribute to reducing income inequality in Asian countries (Deyshappriya, 2017). For both middle and low-income classes, the gender pay gap has a negative effect on the pre-tax national income while gender inequality in both education and LFP has a positive effect on the pre-tax national income. Vasina and Sloka (2019) concluded that gender biases have a negative impact on women's advancement resulting in widening the pay gap, which affects income inequality. Studies have also stated that Indian women who came from poor households and do not have any primary education are more likely to have the highest women's LFP since they could not afford to have any source of income.

Although there has been a combination of a negative and positive relationship between gender inequality in wages, education, LFP, and income distribution among income classes, promoting gender equality is still needed for females to engage in social, political, and economic activities. The beliefs, practices, and norms are evident in creating huge barriers to improving the status of many women in Indian society. Nevertheless, the study recommends that the Indian government can allocate a budget for building new and renovating some education infrastructures to encourage more girls to study. Indian policymakers should make policies that enable women to join the labor force in different sectors wherein equal work benefits are provided for everyone. The government could also adopt effective policies initiated by other countries that had been successful in lowering gender discrimination over the years.

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