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Gender disparities in labour force and wage inequality: A comparative econometric analysis of Uttar Pradesh and India using PLFS 2022-23

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Abstract

Gender disparities in labour market outcomes remain a persistent challenge in India, with significant variation across states and employment categories. Using unit-level microdata from the Periodic Labour Force Survey 2022-23, this study undertook a comprehensive econometric analysis of labour force participation, unemployment, daily wages, and wage inequality among working-age persons (aged 15 years and above) in Uttar Pradesh relative to the all-India pattern, with particular focus on gender differentials across rural, urban, and combined sectors and among regular and casual wage workers. The survey's stratified multi-stage complex design was fully accounted for in all estimates. Labour force participation and unemployment rates were estimated using design-consistent subpopulation estimation. Gender wage gaps were quantified using survey-weighted ordinary least squares regression. Wage inequality was measured using Gini coefficients, generalized entropy indices (including the Mean Log Deviation and the Theil index), and between-within-group Theil decompositions. Non-parametric Kolmogorov-Smirnov tests were applied to formally test the equality of male and female wage distributions. Results showed that female labour force participation in Uttar Pradesh (31.2%) was substantially below both the male rate in the state (79.3%) and the national female average (37.0%), with the urban female participation rate (14.1%) being critically low. Urban female unemployment in Uttar Pradesh was strikingly high at 10.6%, far exceeding the male urban rate of 5.8%. Female casual workers in Uttar Pradesh earned Rs 270.2 per day compared to Rs 396.3 for males, while regular female workers earned Rs 630.8 against Rs 719.5 for males. Gender wage gaps were statistically significant for casual workers across all specifications and for regular workers at the national level. Female wage inequality, as measured by the Gini coefficient, was substantially higher than male inequality in both Uttar Pradesh (0.581 vs 0.346) and India (0.474 vs 0.375) for all wage workers combined. Kolmogorov-Smirnov tests confirmed that male and female wage distributions were statistically distinct at all conventional significance levels. The findings highlight the coexistence of suppressed female labour force participation, persistent gender wage gaps, and pronounced within-gender wage inequality in Uttar Pradesh, underscoring the need for targeted policy interventions addressing both structural employment barriers and wage-setting mechanisms.

Keywords: Gender wage gap, labour force participation, gender wage inequality, Gini coefficients, Uttar Pradesh, India

1. Introduction

Gender inequality in labour markets is a central concern in the study of economic development and structural transformation in India. Over the past decade, India has witnessed both a rise in female labour force participation and persistent gaps in earnings and employment quality relative to men, with substantial variation across states, sectors, and types of employment. Recent official releases based on the Periodic Labour Force Survey (PLFS) show that labour force participation rates have risen for both men and women, and unemployment rates have fallen relative to the initial PLFS round, yet women's participation and employment remain systematically lower than men's, particularly in urban areas and in regular wage employment [1].

The experience of Uttar Pradesh --- the country's most populous state --- plays a pivotal role in shaping national labour market outcomes, but also reflects specific demographic, social, and structural constraints that may generate distinctive gender patterns^[2].

The literature documents multiple dimensions of gender disparities in India's labour market. Studies using National Sample Survey and PLFS data highlighted that women are overrepresented in self-employment and low-paid informal work, and underrepresented in regular salaried jobs with social security benefits^[3, 4]. Evidence also indicated that wage gaps between men and women persisted even after controlling for observable characteristics, suggesting an important role for discrimination and occupational segregation^[5, 6]. The gender wage gap tends to be especially pronounced among casual workers and in urban labour markets, where segmentation by occupation, industry, and formality is stronger^[7]. At the same time, recent work emphasises a complex pattern of wage inequality within and between gender groups, with higher inequality among women in some segments and a non-trivial contribution of sectoral and employment-type differences to overall earnings inequality^[8, 9].

Despite a growing body of research on gender and labour markets in India, there remains limited evidence that closely juxtaposes a large state such as Uttar Pradesh with the national pattern, using recent PLFS unit-level data and an explicitly econometric, inequality-focused lens. Existing studies on Uttar Pradesh often relied on published PLFS tables or earlier NSS rounds and tended to emphasise trends in female labour force participation rather than distributional aspects of wages or inequality metrics. Moreover, while the official PLFS reports provide national indicators by sex and sector, they do not fully exploit the survey's complex design for state-level econometric analysis of wage distributions, regression-based wage gaps, and inequality decompositions. This leaves a gap in understanding how gender wage structures and inequality in Uttar Pradesh compare quantitatively with the all-India picture, especially when regular and casual wage workers are analysed separately.

The present study addresses this gap by using unit-level PLFS 2022-23 data to conduct a detailed econometric analysis of gendered labour market outcomes in Uttar Pradesh vis-à-vis India as a whole. The analysis was restricted to persons aged 15 years and above and followed the PLFS usual principal plus subsidiary status (PS+SS) framework for defining labour force participation, employment, and unemployment.¹ The paper focuses on three interrelated questions. First, how do labour force participation and unemployment rates differ by gender and rural-urban sector in Uttar Pradesh compared to the national pattern? Second, what are the levels and distribution of daily wages among regular and casual wage workers by gender, and how large are the resulting gender wage gaps? Third, to what extent do wage distributions exhibit inequality across and within gender groups, and how do inequality measures in Uttar Pradesh compare with those for India as a whole?

To answer these questions, the study applied a suite of tools standard in labour econometrics, adapted here to the PLFS survey design. Labour force participation and unemployment rates were estimated using design-based survey commands that account for stratification, clustering, and sampling weights. Wage outcomes were examined using survey-weighted means and percentiles to capture central tendency and distributional features for regular and casual workers

separately. Linear regression models with survey weights were used to estimate the conditional female-male wage gap, and wage inequality was quantified through Gini and generalized entropy indices. Non-parametric Kolmogorov-Smirnov tests formally tested distributional equality between gender groups^[10, 11].

The paper's contribution is twofold. Substantively, it provides updated, state-specific evidence on gendered labour market outcomes in India, using PLFS 2022-23, with a focus on Uttar Pradesh's divergence from or convergence with national patterns in participation, wages, and inequality. Methodologically, it illustrates an integrated econometric approach to analysing PLFS unit-level data, combining survey-consistent estimation with regression-based wage-gap estimation and inequality measures in a transparent, replicable way that can be applied to other states and subpopulations.

The remainder of the paper is organized as follows. Section 2 describes the data source, sample construction, key variables, and econometric methods. Section 3 presents empirical results and discussion. Section 4 provides the overall conclusion of the research.

2. Materials and Methods

2.1 Data Source

The empirical analysis was based on the unit-level microdata from the Periodic Labour Force Survey (PLFS) 2022-23, obtained from the publicly available dataset on the online microdata library (<https://microdata.gov.in/>). PLFS is conducted by the National Statistical Office (NSO), Ministry of Statistics and Programme Implementation, Government of India. The PLFS is a nationally representative household survey designed to provide frequent estimates of key employment and unemployment indicators. The survey follows a stratified, multi-stage sampling design: in rural areas, the first-stage units are villages, while in urban areas, the first-stage units are Urban Frame Survey blocks, with households as second-stage units within each first-stage unit. Stratification is done within each district separately for rural and urban areas. The reference period was July 2022 to June 2023.

The analysis was restricted to people aged 15 years and above, consistent with the working-age definition used by the PLFS and International Labour Organization conventions.¹ Persons reported under the third gender category were excluded due to very small cell sizes. The state of Uttar Pradesh was identified by state code 9 in the dataset. All analyses were performed using Stata IC version 13 on a Windows 11 x64-bit platform.

2.2 Key Variable Definitions

Usual Status (PS+SS) combines the principal usual activity (the activity in which the maximum time was spent during the reference year) with the subsidiary usual activity (pursued for at least 30 days but not the principal status), providing comprehensive annual labour force attachment^[1]. The following binary indicators were constructed:

- **Employed:** Usual status codes 11-72 (all categories of workers)
- **Unemployed:** Usual status codes 81-82 (seeking or available for work)
- **Not in Labour Force (NILF):** Usual status codes 91-99
- **Labour force:** Employed or unemployed
- **Regular wage worker:** Usual status code 31
- **Casual wage worker:** Usual status codes 41 and 51

A unified daily wage variable was constructed using regular daily wages for regular workers and casual daily wages for casual workers. Observations with zero or missing wages were excluded from all wage analyses. Also, sampling weights were applied in Stata through two complementary mechanisms: the *svyset* command with *pweight* was used for design-consistent estimation of labour force indicators and regression-based wage gaps, while *aweight* was employed for inequality measures via the *ineqdeco* command. The weight variable was derived from the PLFS unit-level dataset by combining the provided multiplier with household size, sub-sample adjustment factors, and design identifiers — including stratum, sub-stratum, FSU, and second-stage stratum variables — to generate a final individual-level probability weight that reproduces population totals at the geographic and sector level.

2.3 Survey Design Declaration

The primary sampling unit (PSU) was constructed by combining state, sector, stratum, sub-stratum, Field Investigation Division sub-region, and FSU identifiers into a unique group identifier. Stratification was declared at the stratum level, with linearised (Taylor-series) variance estimation and a scaled single-unit correction for strata with only one sampled PSU [10]. All labour market rate estimates and regression coefficients were obtained using this declared complex survey design. Subpopulation estimation, rather than sample restriction, was used throughout to preserve correct variance structures.

2.4 Labour Force Participation and Unemployment Rates

The Labour Force Participation Rate (LFPR) is defined as:

$$\text{LFPR} = \frac{E+U}{P_{15+}} \times 100 \quad (1)$$

Where E is the weighted count of employed persons, U is the weighted count of unemployed persons, and P_{15+} is the total weighted working-age population aged 15 and above.

The Unemployment Rate (UR) is:

$$\text{UR} = \frac{U}{E+U} \times 100 \quad (2)$$

Both rates were estimated as survey-weighted proportions using design-based subpopulation estimation, separately for males and females, by rural, urban, and combined sectors, and for Uttar Pradesh and All India.

2.5 Wage Analysis

Survey-weighted mean daily wages were estimated for regular and casual workers across combinations of gender, region, and sector. Survey-weighted percentile estimates (P10, P25, P50, P75, P90) were computed using probability weights.

The gender wage gap was estimated using survey-weighted OLS regression:

$$W_i = \alpha + \beta \cdot \text{Female}_i + \varepsilon_i \quad (3)$$

Where W_i is the daily wage of worker i , Female_i is a binary indicator equal to 1 for female and 0 for male workers, α is the intercept representing the conditional mean wage for men, β is the raw female-male wage differential in rupees, and ε_i is the error term. This model was estimated separately for

regular and casual workers, for each region, and by sector. The null hypothesis $H_0: \beta = 0$ was tested using a two-sided t-test. A negative and statistically significant β constitutes evidence of a female wage disadvantage.

2.6 Wage Inequality Measures

The Gini coefficient is defined as:

$$G = \frac{1}{2\bar{W}n^2} \sum_{i=1}^n \sum_{j=1}^n |W_i - W_j| \quad (4)$$

Where $\bar{W}$ is the mean wage and n is the weighted number of observations. G ranges from 0 (perfect equality) to 1 (maximum inequality).¹¹

The Generalized Entropy (GE) class of measures is:

$$\text{GE}(\alpha) = \frac{1}{\alpha(\alpha-1)} \left[\frac{1}{n} \sum_{i=1}^n \left(\frac{W_i}{\bar{W}} \right)^\alpha - 1 \right], \alpha \neq 0, 1 \quad (5)$$

For $\alpha = 0$, this reduces to the Mean Log Deviation (MLD):

$$\text{GE}(0) = \frac{1}{n} \sum_{i=1}^n \ln \left(\frac{\bar{W}}{W_i} \right) \quad (6)$$

Which is sensitive to inequality at the bottom of the distribution. For $\alpha = 1$, GE(1) is the Theil index:

$$\text{GE}(1) = \frac{1}{n} \sum_{i=1}^n \frac{W_i}{\bar{W}} \ln \left(\frac{W_i}{\bar{W}} \right) \quad (7)$$

GE(2) is additionally reported as it is sensitive to top-end inequality [11, 12]. These indices were computed using the *ineqdeco* Stata package with analytic weights [13]. The by-group decomposition partitions overall GE inequality into within-gender and between-gender components.

The Concentration Index (CI) of daily wages ranked by sex is:

$$\text{CI} = \frac{2}{\bar{W}} \text{Cov}(W_i, R_i) \quad (8)$$

Where R_i is the fractional rank in the sex distribution (males ranked 1, females ranked 2). A negative CI indicates that wages are concentrated among lower-ranked (male) individuals, computed using the *conindex* Stata package.¹⁴

2.7 Kolmogorov-Smirnov Distributional Test

To test whether the entire wage distribution differs between males and females, the two-sample Kolmogorov-Smirnov (KS) test is applied [15].

$$D = \sup_w |F_M(w) - F_F(w)| \quad (9)$$

Where $F_M(w)$ and $F_F(w)$ are the empirical cumulative distribution functions of wages for males and females respectively. The null hypothesis is that both samples are drawn from the same continuous distribution. Combined two-sided p-values are reported. The KS test was applied separately for regular and casual workers, for Uttar Pradesh and All India.

3. Results and Discussion

3.1 Labour Force Participation and Unemployment

Table 1 presents the LFPR and UR estimates disaggregated by region, sector, and gender. In terms of overall participation, Uttar Pradesh recorded an LFPR of 55.2% (total), nearly identical to the all-India figure of 57.9%. However, this aggregate similarity masked sharp gender and

sectoral divergences. Male LFPR in Uttar Pradesh (79.3%) was broadly comparable to the national male LFPR (78.5%), indicating that male labour force attachment in the state was not substantially different from national norms. The critical divergence lay in female participation: women in Uttar Pradesh had an LFPR of just 31.2%, compared with the national average of 37.0%, a gap of nearly 6 percentage

points. This gap was even more pronounced in urban areas, where female LFPR in Uttar Pradesh stood at only 14.1% compared to 25.4% nationally, a difference of more than 11 percentage points. These findings are consistent with earlier evidence indicating that Uttar Pradesh continues to lag significantly in female urban employment participation^[2].

Table 1: Labour Force Participation Rate (LFPR) and Unemployment Rate (UR) among Working-Age Population (15+), Uttar Pradesh vs India.

Region	Sector	LFPR (%)			UR (%)		
		Men	Women	Total	Men	Women	Total
Uttar Pradesh	Rural	80.7	35.5	57.9	1.8	0.9	1.5
	Urban	74.1	14.1	45.0	5.8	10.6	6.5
	Total	79.3	31.2	55.2	2.6	1.8	2.4
India	Rural	80.2	41.5	60.8	2.7	1.8	2.4
	Urban	74.5	25.4	50.4	4.7	7.5	5.4
	Total	78.5	37.0	57.9	3.3	2.9	3.2

Source: Computed from PLFS 2022-23 unit-level data using design-based subpopulation estimation.

The low urban female LFPR in Uttar Pradesh may be attributed to a combination of patriarchal social norms suppressing women's labour supply, limited access to safe and affordable transportation, occupational segregation confining women to a narrow range of socially acceptable jobs, and the dominance of informal and home-based work that is often underreported in surveys.^{3,4} The rural female LFPR (35.5%) was also below the national rural figure (41.5%), though the gap was smaller than in urban areas, partly because rural women's participation is supported by agricultural and allied activities.

Turning to unemployment, the pattern was distinctly gendered and urban-focused. Among males, the UR in Uttar Pradesh (2.6% overall) was broadly similar to the national rate (3.3%). Female unemployment in rural Uttar Pradesh (0.9%) appeared lower than the national rural female rate (1.8%), but this likely reflected discouraged worker effects rather than genuine employment success: when participation rates are very low, women who cannot find work may not present themselves as jobseekers, thereby suppressing measured unemployment.⁵ The urban female UR in Uttar Pradesh was strikingly high at 10.6%, substantially above the national urban female rate of 7.5% and nearly double the urban male rate within the state (5.8%). This suggests that among the limited number of urban women who did participate in Uttar

Pradesh's labour market, a disproportionately large share faced open unemployment, pointing to a severe mismatch between their qualifications or aspirations and available opportunities.

These findings confirm a labour market paradox: Uttar Pradesh combines very low female participation with high female urban unemployment, signalling both supply-side suppression (social norms, domestic constraints) and demand-side barriers (limited suitable jobs, discrimination) for women.

3.2 Mean Daily Wages

Table 2 presents survey-weighted mean daily wages for regular and casual wage workers by gender and region. For regular workers, the mean daily wage for men in Uttar Pradesh (Rs 719.5) was approximately Rs 109 lower than the national mean for men (Rs 828.4). Women regular workers in Uttar Pradesh (Rs 630.8) earned slightly below the national average for women (Rs 644.8). The female-to-male wage ratio for regular workers in Uttar Pradesh (0.877) was slightly more favourable than at the national level (0.778), suggesting a somewhat less severe relative gap within regular employment in UP, though this must be interpreted cautiously given the small and possibly select sample of female regular workers.

Table 2: Survey-Weighted Mean Daily Wage (Rs) by Worker Type and Sex, Uttar Pradesh vs India

Worker Type	Region	Men	Women	Total
Regular	Uttar Pradesh	719.5	630.8	705.0
	India (All)	828.4	644.8	784.2
Casual	Uttar Pradesh	396.3	270.2	389.6
	India (All)	439.7	274.7	402.7

Source: Computed from PLFS 2022-23 unit-level data. Observations with zero or missing wages were excluded.

For casual workers, the gender wage divide was starker and more uniform. Male casual workers in Uttar Pradesh earned Rs 396.3 compared to Rs 439.7 nationally. Female casual workers in both Uttar Pradesh (Rs 270.2) and All India (Rs 274.7) earned remarkably similar, consistently low daily wages, approximately 68% of male casual wages in Uttar Pradesh and 62% nationally. The compressed absolute wages in casual employment reflect the structure of daily-rated informal labour markets, where workers, especially women, often have limited bargaining power despite statutory minimum wage provisions.

3.3 Wage Percentile Analysis

Tables 3 provide selected wage percentiles, revealing the distributional structure of wages beyond the mean. For regular male workers, the median daily wage in Uttar Pradesh (Rs 414) was considerably below the national median (Rs 559), indicating that the typical regular male worker in Uttar Pradesh earned substantially less than his national counterpart. At the upper tail (P90), values converged, Rs 1,657 in Uttar Pradesh vs Rs 1,760 nationally, suggesting that high-end regular employment is comparable across regions, while deprivation was concentrated in the lower and middle

portions of the distribution. For regular female workers, the P10 in Uttar Pradesh (Rs 77) was dramatically lower than for men (Rs 230), reflecting greater vulnerability at the bottom of the female wage distribution. The P75 for regular women in Uttar Pradesh (Rs 921) exceeded that for men (Rs 767), which reflects a statistical artefact of the small and possibly select group of high-earning female regular workers in the state; this compositional effect should be interpreted with caution.

For casual workers, wages were tightly compressed, reflecting the floor effects of minimum-wage regulation in daily-rated informal work. The female casual median wage (Rs 250) was exactly half the male median (Rs 400) in Uttar Pradesh, and the pattern was similar nationally. The severe concentration of female casual wages at the lower quantiles is consistent with occupational segmentation and gender-based discrimination in casual labour markets.

Table 3: Daily Wage Percentiles (Rs) for Regular Wage/Salaried and Casual Wage Workers, Uttar Pradesh vs India

		P10	P25	Median	P75	P90
Regular Wage/ Salaried Workers						
Uttar Pradesh	Men	230	307	414	767	1657
	Women	77	115	214	921	1757
	Total	181	269	395	767	1740
India	Men	269	384	559	959	1760
	Women	118	210	345	767	1710
	Total	211	329	499	959	1734
Casual Wage Workers						
Uttar Pradesh	Men	300	350	400	400	500
	Women	150	200	250	400	400
	Total	300	350	400	400	500
India	Men	300	350	400	500	600
	Women	150	200	250	330	400
	Total	200	300	400	500	600

Source: Computed from PLFS 2022-23 using _pctl with probability weights.

3.4 Gender Wage Gap Regression Results

Table 4 presents survey-weighted OLS estimates of the female-male wage differential. For regular workers, the estimated female wage gap in Uttar Pradesh was Rs -88.7 ($p = 0.271$), which was not statistically significant at conventional levels. This likely reflected both the small sample sizes of female regular workers in the state and the compositional heterogeneity noted in the percentile analysis. In contrast, at the all-India level, regular female workers earned Rs 183.6 less per day than regular male workers ($p < 0.001$), a highly significant and economically substantial gap. The urban gender gap for regular workers nationally (Rs -200.4) was even larger than the rural gap (Rs -188.5), aligning with existing evidence that occupational segregation and wage

discrimination are amplified in formal urban employment.

For casual workers, the gender wage gap was statistically significant in all specifications. In Uttar Pradesh, casual female workers earned Rs 126.1 per day less than their male counterparts ($p < 0.001$), with this difference consistent across rural (Rs 129.0) and urban (Rs 96.4) areas. At the all-India level, the casual gender gap (Rs -165.0) was larger, with urban casual female workers earning nearly Rs -195 less per day than urban casual males, the single largest gap in the analysis. These estimates support the view that casual labour markets, despite the absence of formal employment contracts, are not insulated from gender-based wage discrimination; the lack of collective bargaining and employment protection may, in fact, amplify gender differentials in this segment.

Table 4: Estimated Female-Male Daily Wage Gap (Rs) from Survey-Weighted OLS — Uttar Pradesh vs India

Region	Total	Rural	Urban
Regular Wage/Salaried Workers			
Uttar Pradesh	-88.75 (-246.74, 69.25)	-117.80 (-340.95, 105.34)	27.51 (-168.36, 223.38)
All India	-183.59*** (-208.57, -158.61)	-188.48*** (-224.59, -152.36)	-200.35*** (-234.08, -166.63)
Casual Wage Workers			
Uttar Pradesh	-126.10*** (-154.06, -98.14)	-129.02*** (-158.96, -99.07)	-96.39*** (-152.89, -39.89)
All India	-164.97*** (-176.20, -153.73)	-155.42*** (-171.33, -139.52)	-194.95*** (-209.77, -180.13)

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Values are female wage gaps (Rs) with 95% CI in parentheses; negative values indicate lower wages for women. Estimates from PLFS 2022-23 using declared survey design with linearized variance estimation.

3.5 Wage Inequality: Gini and Generalized Entropy Indices

Table 5 presents Gini coefficients and GE indices for all wage workers, regular workers, and casual workers.

Table 5: Inequality Indices for All Wage Workers - Uttar Pradesh vs India

	Uttar Pradesh				India			
	Gini	GE(0)	GE(1)	GE(2)	Gini	GE(0)	GE(1)	GE(2)
All types of workers (Regular + Casual)								
Men	0.346	0.216	0.283	0.502	0.375	0.234	0.284	0.465
Women	0.581	0.613	0.628	0.930	0.474	0.378	0.446	0.753
Total	0.379	0.258	0.320	0.547	0.405	0.275	0.321	0.520
Regular Wage/ Salaried Workers								
Men	0.460	0.353	0.386	0.569	0.428	0.304	0.325	0.468
Women	0.604	0.723	0.655	0.865	0.523	0.490	0.479	0.670
Total	0.489	0.415	0.426	0.610	0.453	0.354	0.361	0.511
Casual Wage Workers								
Men	0.098	0.023	0.021	0.022	0.178	0.056	0.056	0.060
Women	0.202	0.069	0.065	0.064	0.188	0.058	0.057	0.060
Total	0.108	0.028	0.026	0.026	0.206	0.074	0.072	0.077

Source: Computed from PLFS 2022-23 using the ineqdeco Stata package with analytic weights.

Several findings stand out clearly. First, female wage inequality was substantially higher than male wage inequality across both regions and all worker types. For all wage workers in Uttar Pradesh, the female Gini (0.581) was nearly 68% higher than the male Gini (0.346). At the all-India level, the female Gini (0.474) exceeded the male Gini (0.375) by approximately 26%. The GE(0) MLD for women in Uttar Pradesh (0.613) was nearly three times the male value (0.216), indicating that inequality among female wage workers was heavily driven by outcomes at the lower end of the distribution, where many women were concentrated in very low-wage activities.

Second, Uttar Pradesh exhibited higher female wage inequality than the national average, particularly for regular workers. The female regular Gini in Uttar Pradesh (0.604) exceeded the national female regular Gini (0.523), while the male regular Gini was also higher in UP (0.460) than nationally (0.428), suggesting that the regular wage labour market in Uttar Pradesh is more dispersed for both genders.

Third, casual worker wage inequality was low overall, reflecting the compressed nature of daily-rated informal wages. Gini values ranged from 0.098 (UP males) to 0.206 (India combined). Interestingly, female casual workers in Uttar Pradesh (Gini = 0.202) showed higher inequality than in the national sample (Gini = 0.188), indicating that even within the compressed casual sector, the distribution of female wages in UP is more unequal. The Theil decomposition by gender revealed that between-gender inequality contributed meaningfully to overall earnings inequality in both regions, in addition to substantial within-group inequality, particularly within the female group.

3.6 Kolmogorov-Smirnov Distributional Tests

Table 6 presents the KS test results comparing the wage distributions of males and females.

Table 6: Kolmogorov-Smirnov Test for Equality of Male and Female Wage Distributions — Uttar Pradesh vs India

	Uttar Pradesh	All India
Regular Wage/ Salaried Workers	0.42***	0.28***
Casual Wage Workers	0.45***	0.57***

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Values are D-statistics from distributional tests comparing male and female wages. Estimates based on PLFS 2022-23 using the declared survey design.

All D-statistics were large, and all p-values were < 0.001 , confirming that male and female wage distributions are statistically distinct at all conventional significance levels for all worker types and both regions. For casual workers, the D-statistic was larger (0.45 in UP; 0.57 in India) than for regular workers (0.42 in UP; 0.28 in India). The exceptionally large D-statistic for casual workers at the all-India level (0.57) indicates that the male and female casual wage CDFs diverge substantially across the entire wage range, not just at the mean. This confirms that the gender wage gap in casual employment is a distributional phenomenon pervasive across all quantiles, rather than being driven by extreme outliers. The KS results provide robust non-parametric corroboration for the regression-based estimates in Section 3.4 and validate the inequality findings in Section 3.5.

4. Conclusion

This study examined gendered labour market outcomes in Uttar Pradesh vis-à-vis the all-India pattern using unit-level data from the PLFS 2022-23, applying a comprehensive suite

of econometric and inequality measurement tools. The central findings can be summarised across three dimensions.

In terms of participation and unemployment, female labour force participation in Uttar Pradesh is significantly below the national average, most acutely in urban areas where only 14.1% of working-age women participate, less than half the national urban female LFPR of 25.4%. Urban female unemployment in Uttar Pradesh (10.6%) is the highest recorded in the analysis, pointing to a dual challenge of suppressed participation and high open unemployment among those who enter the labour force. These patterns indicate that structural, social, and demand-side barriers to women's employment in Uttar Pradesh remain formidable despite recent national improvements in female labour force participation.

Regarding wage levels and gaps, both regular and casual female workers in Uttar Pradesh earn substantially less than their male counterparts. While the raw gender wage gap for regular workers in Uttar Pradesh is not statistically significant, likely due to small female sample sizes and compositional heterogeneity --- it is economically non-trivial at Rs -88.7 per day. For casual workers, the gap is both large (Rs -126.1 per day) and highly significant and is consistent across rural and urban areas. At the national level, gender wage gaps are significant for both worker types, with the largest absolute gap observed among urban casual workers (Rs -195 per day).

With respect to wage inequality, female workers in Uttar Pradesh face significantly higher inequality than male workers, most strikingly among all wage workers (Gini = 0.581 vs 0.346) and among regular workers (Gini = 0.604 vs 0.460). This high within-gender inequality for women reflects heterogeneity among the small and select group of female wage workers, ranging from very low-wage casual agricultural labourers to relatively better-paid formal regular employees. The KS tests confirm that male and female wage distributions are fundamentally different across the entire wage range, reinforcing the conclusion that gendered wage inequality is a pervasive distributional feature.

The evidence points to the need for multi-pronged policy interventions. Policies to increase female participation, including investment in urban public transport and safe infrastructure, expanding affordable childcare, addressing social-norm barriers, and strengthening equal-pay enforcement, are necessary but not sufficient. Reducing wage inequality among women will additionally require addressing occupational segregation, improving access to formal employment and skills, and extending social protection to casual and informal workers. Future research could extend this framework by using multiple rounds of PLFS for trend analysis and by incorporating the Oaxaca-Blinder decomposition to separate the explained (endowment) and unexplained (discrimination) components of the gender wage gap.

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