

Riding the Trade Waves: Gender-Differentiated Employment Dynamics in Asia

Ayesha Anwer

Govt. Queen Mary Graduate College, Lahore. Email: ashanw89@gmail.com

Atif Khan Jadoon

School of Economics, University of the Punjab, Lahore.

Email: atifkhan.eco@pu.edu.pk

Sania Zafar

University of Jhang, Jhang. Email: saniazafar@uoj.edu.pk

Muhammad Yasar Sattar

Lecturer, PAC College, Lahore, Pakistan. Email: yasarsattar8@gmail.com

Abstract

International trade plays a critical role in shaping labour market dynamics across economies around the world. However, instability or fluctuations in trade flows, referred as the trade volatility, can influence employment patterns across genders. This study examines how trade fluctuations effect gender-differentiated employment among Asian economies. Using data from the World Bank database for the period from 2011 to 2023, covering 11 Asian countries, this study implies panel-data estimation techniques, including fixed and random effects models to control for unobserved heterogeneity. Two separate models are estimated in the empirical analysis for male and female employment shares. The findings reveal that trade volatility has a statistically significant impact on female employment as compared to male employment across Asian region. The empirical findings show that females are more vulnerable to external trade shocks in Asian labour markets. Overall, the study underscores the importance of implementing gender-targeted policies to mitigate the negative impacts of uncertainty in trade flows and for the promotion of more inclusive employment outcomes.

Keywords: Trade volatility, Asian economies, panel data, gender-disaggregated employment

JEL Classification: F16, J16, O53

1. Introduction

Trade-driven globalization has fundamentally reshaped labor markets, particularly through trade openness, yet its implications for gender-disaggregated employment remain underexplored in the developing Asian region. Trade liberalization is generally associated with higher female labor force participation (Sarwar & Jadoon, 2020; Wang, 2023; Rossi, 2023; Farhadi & Zhao, 2024; Kumar & Wu, 2025; Alvi & Mudassar, 2025; Soliman,

2025) through export-oriented sectors such as textiles and garments. However, trade volatility or fluctuations in export-import ratios may disrupt these gains, especially for women concentrated in tradable, low-skilled industries ((Bank, 2020). In Asia, where female employment shares lag (e.g., 25-40% vs. male 50-70%), understanding whether fluctuations in trade hamper or hasten female participation in the labor market is critical for policy-making amid rising global protectionism (Autor, Dorn, & Hanson, 2013; Ahmad & Naeem, 2017; Audi & Ali, 2018; Hussain & Kahn, 2022; IMF, 2022; Ahmad et al., 2022; Hanvoravongchai & Paweenawat, 2025).

Despite extensive research on trade fluctuations and labor markets, few studies have examined gender-specific employment effects in Asia. Understanding these differential impacts is crucial for targeted gender-specific policy. This study investigates the trade volatility's differential effects on male versus female employment shares using two-way fixed and random-effects panel analysis on 11 Asian economies (Bangladesh, China, India, Indonesia, Japan, Korea Rep., Malaysia, Pakistan, Sri Lanka, Thailand, Vietnam) between the time period from 2011 to 2023. Trade volatility, defined as fluctuations in trade, is measured as the 3-year rolling standard deviation of (exports + imports)/GDP, capturing short-run shocks that are absent in level-based openness metrics (Siddiqi et al., 2014; Ibrahim & Simian, 2023; Audi, 2024; Ali et al., 2025; Jung, 2026). In consistency with the existing literature, this study includes control variables like GDP per capita, inflation rate (CPI), population growth, and female labor force participation (Autor et al., 2013; Ali & Chani, 2013; Helpman et al., 2016; Ahmad et al., 2018; Skhirtladze & Nurboja, 2019; Porro & Gia, 2021; Weber, 2022; Hamza et al., 2025; Al Rasasi, 2025), with two-way fixed effects panel analysis to capture both country and time effects, addressing unobserved heterogeneity.

The existing literature links trade to female gains (Topalova & Khandelwal, 2011), but the role of trade volatility is increasingly recognized. Some earlier research on Latin America indicates that trade uncertainty reduces female working hours (Menezes-Filho & Muendler, 2011), whereas studies of Asian economies yield mixed results (Felbermayr, Prat, & Schmerer, 2011; Ali, 2011). In previous studies, no panel analysis examines gender asymmetry due to trade volatility and shocks, overlooking country- and time-specific dynamics via two-way fixed effects and time effects panel analyses, which this study addresses.

The findings indicate that trade volatility has a significant impact on female employment in Asia, but less so on male employment. This suggests that trade shocks encourage firms to hire more women, particularly in flexible

sectors where jobs are more adaptable, and that female employment may increase despite initial low labor-market participation. Policy measures should focus on minimizing fluctuations and uncertainty in trade, for example, through trade insurance, while sustaining openness.

The study focuses on two questions:

- Is the impact of trade volatility different for male and female workers?
- Are women more vulnerable to trade shocks in Asia?

1.1. Significance of the Study

This analysis holds significance for three reasons. Firstly, this study contributes to the gender-based trade literature by shifting the focus from trade levels to trade volatility. Secondly, the findings show that trade volatility affects male and female employment differently, suggesting the need for gender-targeted trade policies. Thirdly, the study of 11 Asian economies highlights the strategies of international organizations, such as the WTO/ADB, aimed at balancing trade openness with labor equity.

2. Literature Review

During the 1990s, Asian economies implemented export-oriented growth methods that deeply linked them into global markets. Primary empirical research highlighted how outward-looking industrialization transformed labor markets across Southeast and East Asia. Wood (1997) argued that trade openness in developing Asian economies increased demand for low-skilled labor due to comparative advantage in labor-intensive goods. Revenga (1997) also found that many reforms in Mexico's trade impacted jobs and wages across industries. Estudillo and Otsuka (1999) showed that the growth in exports in East Asia significantly enhanced employment in labor-intensive manufacturing sectors. They documented how export-led growth ways reshaped labor markets in East Asia, particularly in labor-intensive manufacturing sectors. These previous studies focused mainly on trade openness rather than trade volatility.

Adding another dimension, Standing (1999) argued that globalization has enhanced female employment in adaptive manufacturing sectors. In Southeast and East Asia, women were increasingly concentrated in textiles, garments, and electronics industries, sectors most affected by export expansions. In line with this, Kucera and Milberg (2000) revealed that manufacturing trade expansion in developing Asia was strongly associated with female-intensive industries, especially textiles, apparel, and electronics. Seguino (2000) analyzed semi-industrialized economies, which include Asian countries, and suggested that gender wage gaps and export growth were structurally linked. Kucera and Milberg (2000) highlighted that there was

asymmetry in female employment in labor-intensive export manufacturing such as electronics and textiles, making them more vulnerable to trade dynamics. Fallon and Lucas (2002) found that a sharp decline in employment in Asian economies hit by a crisis occurred specifically in export-oriented industries. Female-dominated sectors such as electronics and textiles experienced substantial job losses. Similarly, Riaz, Shah, Jadoon, and Iqbal (2024) proved trade led hypothesis for South Asia.

Giovanni and Levchenko (2009) study demonstrated that trade openness can increase output volatility through sectoral specialization. For Asian economies that depend more upon exports, this study suggests that specialization in manufacturing sectors may increase vulnerability to external trade shocks. Haddad, Lim, Pancaro, and Saborowski (2013) examined how trade openness relates to trade volatility and showed that countries with weak institutions can experience growth instability. Most underdeveloped Asian economies fall into this category, suggesting that trade volatility may destabilize labor markets. However, high-level data on male and female employment for the Asian region remained unavailable during this period. Bems, Johnson, and Yi (2010) found that trade contractions were driven by global supply chains (GVCs). In Asia, including China, Malaysia, Thailand, and Vietnam, manufacturing employment has declined sharply in export-dependent economies.

According to the Razavi (2012), females in the export-related manufacturing sector were disproportionately affected due to their high concentration in trade-related sectors. This period reinforced the idea that external demand shocks can create significant employment insecurity in Asia, particularly in industries with higher female employment. During the 2010s, research has focused more on gender-disaggregated labor results in Asia. Sauré and Zoabi (2014) showed that female labor force participation was highly affected by trade patterns depending on sectoral specialization. Trade expansion increased female employment in economies specializing in female-intensive industries. Brussevich, Dabla-Norris, and Khalid (2019) argued in IMF research that structural features, such as occupational segregation, amplify the gendered effects of globalization and technological change in emerging Asian economies.

Alon, Doepke, Olmstead-Rumsey, and Tertilt (2020) argued that sectoral composition plays a central role in gender-differentiated employment shocks. In Asia, where women are concentrated in export-oriented manufacturing sectors such as garments and electronics, trade-related disruptions disproportionately affected female workers. Góes, Lopez-Acevedo,

and Robertson (2023) extended the traditional focus on trade openness and developed a new framework showing that when the female-intensive sector is hit by foreign demand shocks, the female-to-male employment ratio increases, whereas these shocks have the opposite impact on male-intensive sectors. Heckl (2024) found that import competition in Mexico has reduced employment for both women and men, but has also encouraged women to pursue self-employment. This study also suggested that, in the face of trade volatility, the informal sector can buffer women. Parey, Irastorza-Fadrique, and Levell (2025) studied households' responses to trade shocks by gender and employment status and found that trade shocks affect men and women differently. They have explored the effects of rising Chinese import competition at the household level. Their findings showed that males are more exposed to this trade shock than females and are more likely to move towards self-employment. The study also showed that self-employment opportunities are less for females, showing little change in women's labor supply.

The existing literature connects trade openness and shocks to labor market outcomes (Autor et al., 2013; Goldberg & Pavcnik, 2007; Mehmood et al., 2013; Hwang & Lee, 2019; Arshad & Mukhtar, 2019; Naik, 2020; Soliman, 2025) and to gender-specific effects (Góes et al., 2023; Nordås, 2003), but focuses on levels rather than volatility. Asian studies have placed more emphasis on openness and female LFP (Voumik, 2019; Sun & Chang, 2020; Andreou, 2021; Mealli, 2021; Voumik et al., 2023; Cizakca, 2024; Liu & Cai, 2025), neglecting trade fluctuations and their gender-disaggregated impacts (Alzahrani & Salah, 2020; Mordecai & Akinsola, 2021; Irfan & Sohail, 2021; Lin et al., 2023; Shafique & Bhutta, 2023). In the panel analysis, two-way fixed effects are used to isolate within-country volatility effects on male vs. female employment shares. This study fills this gap with volatility-focused, gender-specific panels across 11 Asian economies.

3. Theoretical Framework

3.1. Trade Theories and Gender-Differentiated Employment under Trade Volatility

Analyzing how trade volatility affects gender employment requires grounding the analysis in major international trade theories. This section draws on classical and modern trade theories to explain the mechanisms through which fluctuations in trade influence gender-differentiated labor outcomes in Asian economies.

3.2. Heckscher–Ohlin Model and Factor Endowments

The Heckscher–Ohlin Model states that countries export goods according to the relative abundance of their factors of production. Most Asian economies

are abundant in labor, so they specialize in producing labor-intensive goods such as textiles, garments, and electronics.

According to the Stolper–Samuelson theorem, free trade can lead to higher real returns to the abundant factor (such as labor in developing countries). So, that's why trade openness should increase labor demand in Asian economies, assuming perfect labor mobility across sectors, full employment, and no supply shocks. When trade fluctuates rather than rises steadily, uncertainty about labor demand in export-oriented sectors also arises. Since females in Asia are disproportionately concentrated in export-oriented industries with abundant labor, fluctuations in trade may cause disproportionate employment impacts across genders. In tradable sectors, a high concentration of female labor and volatility in trade can lead to more female employment than male employment.

3.3. Specific Factors Model: Short-Run Adjustment and Sectoral Rigidity

The Specific Factors Model offers a realistic view of a short-period model. In this model, Capital is associated with the specific sector, and labor is mobile between sectors, although its adjustment is slow in the short run. Variations in export demand can cause fluctuations in output from tradable sectors. This can also influence employment and wages. As women are mostly employed in export-specific sectors (such as textiles and garments), an adverse trade shock in these sectors may reduce labor demand. Male labor involved in construction and domestic services is generally less affected by these trade shocks. Trade volatility tends to cause short-run job losses concentrated in gender-disaggregated export sectors.

3.4. New Trade Theory and Increasing Returns

The New Trade Theory, associated with Paul Krugman, shows how increasing returns to scale & imperfect competition, along with differences in market size, shape international trade. Sectors characterized by increasing returns to scale experience rapid trade growth during trade booms but may decline rapidly during a trade depression, due to scale economies. Employment adjusts slowly in sectors with high fixed costs. In scale-intensive manufacturing industries linked to global value chains, abrupt fluctuations in export demand can lead to disproportionate job losses among women.

3.5. Trade and Labour Market Segmentation

Recent trade-labor literature highlights the segmentation of the labor market & persistence of gender-biased inequality. Most of the export industries in the developing Asian region often present gender-based wage gaps, occupational segregation, and short-term labor agreements. With the expansion of trade,

firms tend to hire more women because they are assumed to be more flexible and willing to work at lower wages. During a bad time in business, women are also the first ones to lose their jobs because they have weaker bargaining power. This framework connects trade fluctuations to asymmetric employment outcomes. Expansion in trade may increase female employment, while a downturn disproportionately reduces it, creating instability in women's labor market shares.

3.6. New-New Trade Theory (Firm Heterogeneity)

The Melitz Model incorporates firm-level differences into trade analysis. According to this model, only the most productive firms succeed in exporting, while less productive firms are forced to leave during negative trade shocks. When trade becomes more volatile, Marginal exporters leave markets, leading to fewer employment contracts in exporting firms and more flexible labor demand. If women are more employed in exporting firms, they are more at risk of firm-level exit and contraction. Trade volatility can be a major driver of increased employment instability, particularly in female-intensive exporting firms.

3.7. Risk, Uncertainty, and Real Options Theory

Trade volatility creates uncertainty in export revenues. Due to such uncertainty, firms delay hiring, employment becomes more short-term, and adjustment costs also increase. Export-oriented firms dealing with uncertainty in foreign demand may cut back on permanent employment. Since females are more likely to be employed in temporary or informal jobs, uncertainty can disproportionately undermine the stability of female employment.

3.8. Structural Transformation and Gender

Development theory suggests that as economies grow, employment shifts from agriculture to manufacturing and services, and female labor force participation often follows a U-shaped trajectory. However, the expansion of the manufacturing sector has been a key driver of women's employment in export-led Asian economies. If trade volatility distorts growth in export-oriented manufacturing, this structural transformation can slow, affecting female employees more than male employees.

4. Data and Methodology

4.1. Data Collection and Sample

This study investigates how trade volatility affects gender-based employment across 11 Asian countries (Bangladesh, China, India, Indonesia, Japan, Korea Rep., Malaysia, Pakistan, Sri Lanka, Thailand, Vietnam) for the period 2011-2023. The countries selected for the analysis represent a mix of developing and emerging Asian economies.

The annual data for all the variables are sourced from the World Bank's World Development Indicators (WDI). Trade data consists of export and import data used to measure fluctuations in trade. Whole male and female employment data measures the share of each in the labor force among the working population. Several control variables are also included in the analysis to account for other factors influencing male and female employment: GDP per capita (2015 USD constant), inflation (consumer price index), population growth rate, and the labor force participation rate for females.

However, there are some data limitations. WDI provides annual employment shares; informal and underreported employment is not captured, which may affect the full picture of male and female labor participation.

The hypotheses tested in this study are as follows:

Hypothesis(H1): *Trade Volatility has a significant impact on female employment.*

Hypothesis(H2): *Trade Volatility has a significant impact on male employment.*

4.2. Definition of Variables and Measurement

4.2.1. Male and Female Employment

Male and female employment shares are measured as the proportion of the total labor force by gender in the working-age population.

4.2.2. Trade Volatility (Rolling Standard Deviation)

Trade volatility is defined as fluctuations in trade openness. So, it is computed as the rolling standard deviation of the growth rate of trade openness, which is measured as the ratio of total trade (imports plus exports) to GDP. To capture short-term variations in trade, a k-year moving window is used after taking the first difference of the natural logarithm of trade openness.

$$TV_{it} = \sqrt{\frac{1}{k-1} \sum_{j=0}^{k-1} (g_{i,t-j} - \bar{g}_{it})^2}$$

Where:

- TV_{it} = Trade volatility
- g_{it} = Trade growth
- k = window length (e.g., 3 or 5 years)
- \bar{g}_{it} = mean growth over the rolling window

Control Variables

Control variables are selected based on the literature, suggesting significant factors that explain the impact of trade volatility on gender-based employment. A brief description of the control variables is given below:

GDP per capita (constant 2015 US\$) represents the average annual output of an economy and is an indicator of a country's level of economic development. It is measured by dividing an economy's total annual gross domestic product by its total population, and is expressed in 2015 US Dollars to remove the effect of inflation. A higher level of GDP is usually associated with better economic development and more employment opportunities.

Inflation (Consumer Price Index) is the general price level of goods and services and is measured as the annual percentage change in the Consumer Price Index. This measure serves as an indicator of macroeconomic stability. High inflation can negatively impact employment by increasing uncertainty and reducing purchasing power.

The population growth rate measures the annual percentage increase in the economy's population. It captures the labor supply pressures in the labor market and demographic dynamics. High population growth increases the competition in the labor market, thereby influencing employment outcomes. The labor force participation rate for females is the percentage of the economically active female population aged 15 or older, including both employed and unemployed individuals seeking employment. This variable is an important determinant of women's labor-market engagement.

4.3. Empirical Models

Gender-Specific Employment Models

Two separate models are estimated to analyse the impact of trade volatility on female and male employment across Asia.

4.3.1. Female Employment Model

$$Emp_{female,it} = \beta_0 + \beta_1 TradeVol_{it} + \beta_2 GDPpc_{it} + \beta_3 InfCPI_{it} + \beta_4 PopGrowth_{it} + \beta_5 LFP_{female,it} + \mu_i + \lambda_t + \varepsilon_{it}$$

Male Employment Model

$$Emp_{male,it} = \beta_0 + \beta_1 TradeVol_{it} + \beta_2 GDPpc_{it} + \beta_3 InfCPI_{it} + \beta_4 PopGrowth_{it} + \beta_5 LFP_{male,it} + \mu_i + \lambda_t + \varepsilon_{it}$$

i=1,2, 3, ,11, t= 2011,2012,, 2023

Where μ_i is defined as country fixed effect, λ_t is defined as year fixed effect, & ε_{it} is the error term.

Table 1: Variables Description

Variable	Measurement	Expected Sign	Source
Emp _{female}	Share of female employment in total Labour force (%)	-	WDI
Emp _{male}	Share of male employment in total Labour force (%)	-	WDI

Variable	Measurement	Expected Sign	Source
TradeVol	Trade volatility: 3-year rolling standard deviation of ((Exports + Imports)/GDP)	-	WDI
GDPpc	GDP per capita (constant 2015 USD)	+	WDI
InfCPI	Inflation rate (%) based on Consumer Price Index	-	WDI
PopGrowth	Annual population growth rate (%)	±	WDI
LFPfemale	Female Labour force participation rate (%)	±	WDI

Note: WDI = World Development Indicators database published by the World Bank.

4.4. Estimation Strategy

To analyze the impact of trade volatility on female and male employment, both models have been estimated separately using Fixed-Effects and Random-Effects panel regressions, as suggested by Baltagi (2008) and Semykina and Wooldridge (2010). The models were initially estimated using two-way effects to capture unobserved heterogeneity across countries and over time and to identify the relationship between time-varying independent and dependent variables.

4.4.1. The Fixed Effects Method

In the fixed effects method of panel estimation, the constant is treated as section-specific. This means the model allows different constants for each section. The general form of the model is as follows

$$Y_{it} = \alpha_i + \beta X_{it} + \delta Z_{it} + e_{it},$$

Where Y_{it} is the dependent variable for country i at time t , while X_{it} is the independent variable and Z_{it} is the vector of control variables and e_{it} is the error term.

4.4.2. The Random Effects Method

This is an alternative method for panel data estimation. The main difference between the two methods is that the random effects method treats constants for each section as random rather than fixed. So, the variability in the constants comes from:

$$\alpha_i = \alpha + v_i, \text{ where } v_i \text{ is the mean standard random variable.}$$

The Random Effects Model are of the form:

$$Y_{it} = \alpha + v_i + \beta X_{it} + \delta Z_{it} + v_i + u_{it}$$

In the Random Effects Model, we assume that individual effects are uncorrelated with the regressors. The Random Effects Model has following advantages.

1. It has fewer parameters to estimate that can ease the estimation process.
 2. It allows dummies to use additional explanatory variables.
- In general, the main difference between the two estimation techniques is that the Random Effects model assumes that each economy differs in its error term, whereas the Fixed Effects model assumes that each economy differs in its intercept form.

4.4.3. Hausman Test

To determine the best estimation technique, the Hausman Test proposed by Hausman (1978) has been employed to choose between the Random Effects Model and the Fixed Effects Model. The null hypothesis of the Hausman Test is that there is no correlation between the regressors and the individual effects. The alternative hypothesis states that such a correlation exists, making the fixed-effects model more appropriate and more significant.

The Hausman Test applies as follows to determine the appropriate estimator:

$$H = (\hat{\beta}_{FE} - \hat{\beta}_{RE})' [Var(\hat{\beta}_{FE}) - Var(\hat{\beta}_{RE})]^{-1} (\hat{\beta}_{FE} - \hat{\beta}_{RE}) \sim \chi^2(k)$$

H₀: Random Effect is consistent and efficient

H₁: Random Effect is inconsistent, Fixed Effect is preferred

We reject the null hypothesis if the statistic is large, indicating that Fixed Effects is preferred. On the contrary, for a small p-value, the null hypothesis is rejected, the random effect is preferred, and the result is consistent.

In this study, the Hausman test fails to reject the random-effects model for the female employment model, whereas for the male employment model, it indicates that fixed effects are preferred.

Robustness checks include: (i) alternative rolling windows for trade volatility (3-year), (ii) lagged trade volatility to reduce potential endogeneity concerns, and (iii) country-clustered standard errors to account for heteroskedasticity and serial correlation.

5. Results and Discussion

To estimate the models of female and male employment using both fixed-effects (FE) and random-effects (RE) panel models with two-way effects (controlling for individual and time effects). The dataset is an unbalanced panel of 10 countries over 1–13 years, with a total of 127 observations. The explanatory variables include trade volatility (trade_vol), GDP per capita (gdp_capita), inflation (inf_cpi), population growth (pop_growth), and female labour force participation (lfp_female).

Table 2: Effects of Trade Volatility on Female Employment using Fixed Effects (FE)

Predictor	B	SE	t	p
Trade Volatility	7.34	4.99	1.47	.144
GDP per Capita	0.00023	0.00014	1.64	.104
Inflation (CPI)	0.093	0.096	0.97	.334
Population Growth	2.86	2.36	1.21	.229
Female LFP	0.829	0.061	13.62	< .001

Note: B= unstandardized coefficient; SE= standard error

R² = .700, Adjusted R² = .618

F = 46.14, p < .001

In the two-way fixed-effects model for female employment shares, only female labour force participation emerges as statistically significant ($\hat{\beta} = 0.829$, SE = 0.061, t = 13.62, p < 0.01), indicating that a 1 percentage point increase in female LFP raises the female employment share by 0.83 percentage points, holding country-year effects constant. Trade volatility shows the expected positive value of the coefficient (*i. e.*: $\hat{\beta} = 7.34$, t = 1.47) but it is not statistically significant. This suggests that fluctuations in trade shocks within a country do not appear to have a strong impact. GDP per capita, inflation, and population growth exhibit positive but insignificant coefficients. The model fits well (R² = 0.700, adjusted R² = 0.618; F = 46.14, p < 0.001), accounting for substantial variation beyond the fixed effects.

Table 3: Effects of Trade Volatility on Female Employment using Random Effects (RE)

Predictor	B	SE	t	p
(Intercept)	-12.27	0.923	-13.28	<.001
trade_vol	4.48	0.924	4.84	<.001
gdp_capita	0.000133	0.000020	6.57	<.001
inf_cpi	0.128	0.018	7.04	<.001
pop_growth	1.412	0.359	3.94	<.001

Note: B= unstandardized coefficient; SE= standard error

R² = .662, Adjusted R² = .648

Variance Decomposition: 52.20%, individual effects, 25.78% idiosyncratic effects, 0% time effects. The random-effects model reveals all covariates as highly significant at the 1% level. Trade volatility positively impacts female employment ($\hat{\beta} = 4.48$, SE = 0.924, z = 4.84, p < 0.01), with a one-unit rise in the 3-year rolling SD of trade openness boosting the female share by 4.48 percentage points a finding consistent with trade shocks facilitating female

labour integration (Ul-Haq, Arif, Hye, Visas, & Cheema, 2023; Voumik et al., 2023). Female LFP remains dominant ($\hat{\beta} = 0.794$, $z = 71.22$), alongside positive effects from GDP per capita ($\hat{\beta} = 0.000133$, $z = 6.57$), inflation ($\hat{\beta} = 0.128$, $z = 7.04$), and population growth ($\hat{\beta} = 1.412$, $z = 3.94$). Model fit is strong ($R^2 = 0.662$), with variance primarily from individual effects (52.20%).

5.1. Hausman Test for Female Employment Model

The Hausman test ($\chi^2 = 1.56$, $df = 5$, $p = 0.906$) fails to reject the null hypothesis of random-effects consistency relative to fixed effects. Thus, the random-effects estimator is preferred for female employment, as differences between FE and RE coefficients are uncorrelated with unobserved heterogeneity.

Table 4: Effects of Trade Volatility on Male Employment using Fixed Effect (FE)

Predictor	B	SE	t	p
Trade Volatility	0.239	2.398	0.10	.921
GDP per Capita	-0.000187	0.000077	-2.43	.016
Inflation (CPI)	0.043	0.042	1.03	.305
Population Growth	0.806	1.020	0.79	.432
Female LFP	1.654	0.116	14.28	< .001

Note: B= unstandardized coefficient; SE= standard error

$R^2 = .696$, Adjusted $R^2 = .655$

$F = 50.83$, $p < .001$

For male employment, two-way fixed effects confirm female LFP's strong positive influence ($\hat{\beta} = 1.654$, $SE = 0.116$, $t = 14.28$, $p < 0.01$), where a 1 percentage point LFP increase elevates the male share by 1.65 points, potentially via aggregate demand spillovers. The coefficient of GDP per capita indicates a small but negative effect ($\hat{\beta} = -0.000187$, $t = -2.43$, $p = 0.016$), highlighting a structural shift in developed economies in Asian region. Trade volatility is insignificant ($\hat{\beta} = 0.239$, $t = 0.10$), as are inflation and population growth. Fit is robust ($R^2 = 0.696$, $F = 50.83$, $p < 0.001$).

Table 5: Effects of Trade Volatility on Male Employment using Random Effect (RE)

Predictor	B	SE	z	p
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Predictor	B	SE	z	p
Intercept	-35.05	5.319	-6.59	< .001
Trade Volatility	1.468	2.476	0.59	.553
GDP per Capita	-0.000135	0.000077	-1.75	.079
Inflation (CPI)	0.056	0.044	1.27	.204
Population Growth	1.730	1.035	1.67	.094
Female LFP	1.398	0.104	13.43	< .001

Note: B= unstandardized coefficient; SE= standard error

$R^2 = .646$, Adjusted $R^2 = .632$

$\chi^2 = 223.45$, $p < .001$.

Random effects mirror FE patterns but with marginal significance for GDP per capita ($\hat{\beta} = -0.000135$, SE = 0.000077, z = -1.75, p = 0.079) and population growth ($\hat{\beta} = 1.730$, z = 1.67, p = 0.094). Female LFP dominates ($\hat{\beta} = 1.398$, z = 13.43, p < 0.01), while trade volatility remains insignificant ($\hat{\beta} = 1.468$, z = 0.59). Overall fit: $R^2 = 0.646$ ($\chi^2 = 223.45$, p < 0.001).

Hausman Test for Male Employment Model

The Hausman specification test ($\chi^2 = 17.56$, df = 5, p = 0.004) rejects the null of random-effects consistency, confirming fixed effects as the appropriate estimator for male employment due to correlation between regressors and country-specific unobservable.

6. Conclusion and Policy Recommendation

This study shows that trade volatility has asymmetric effects on female and male employment shares across 11 Asian economies during 2011-2023. Random-effects estimates preferred by the Hausman test for females indicate that trade shocks significantly increase the female employment share ($\hat{\beta} = 4.48$, p < 0.01), likely via necessity-driven entry into tradable sectors, in the presence of volatility. The results of the analysis of the male employment model using the fixed-effects estimation technique, as favored by the Hausman test, show no significant impact of trade volatility. In contrast, participation of the female labor force remains consistently strong and statistically significant across all specifications (t >13). Additionally, Robustness checks using lagged variables and country-clustered standard errors yield similar patterns and account for nearly 70% of the within-country variation. The study's empirical results challenge the common perception that trade volatility can adversely affect labor market outcomes. Contrary to this, the findings of this analysis suggest trade volatility can lead to an increase in female employment in the export-oriented economies in Asia, where females

are mostly associated with manufacturing employment, but unfortunately, can also face many job barriers. Moreover, the difference between the results of the two-way fixed-effect and random-effect models highlights considerable heterogeneity across economies, indicating that country-specific analysis matters more and that reliance on aggregate models may overlook important differences.

6.1. Policy Recommendations

- Policies that promote trade openness should also focus on improving women's skills; for example, vocational training programs initiated in Bangladesh and India have increased female labor force participation.
- Rather than controlling trade fluctuations, the government should manage them by investing in gender-inclusive employment initiatives that allow the labor market to respond efficiently to fluctuations in global demand.
- The government should provide trade facilities, such as export processing zones, to sustain employment opportunities, particularly for women who are often associated with export-oriented sectors.
- International organizations and national statistical institutions should strengthen the data system by providing more detailed information on how trade fluctuations affect gender-disaggregated employment levels. Better data helps policymakers to monitor labor market outcomes.

6.2. Limitations

This study is based on relatively short time periods of 1-13 years, and trade volatility is measured using a 3-year rolling window. Because of these limitations, future research could incorporate more detailed data, such as micro-level firm data or data on global value chains (GVCs), to better understand the impacts of trade fluctuations on gender-based employment patterns. Overall, trade volatility should not be considered solely a risk; with proper management and effective policies, it can create opportunities for gender-equitable employment growth.

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