The Critical Review of Social Sciences Studies

Online ISSN: 3006-7170
Print ISSN: 3006-7162
Volume 4, Number 1, 2026, Pages 2367 – 2382
Journal Home Page
https://thecrsss.com/index.php/Journal/about

Female Labor Force Participation in Selected Developing Asian Economies: The Roles of Fertility, Health, Education, and Digital Access

Sameetah Rafiqui[1], Ghulam Qadir[2], Ashique Ali Lashari[3] & Shujaa Muhammad[4]

[1]*Research Officer at Research and Publication Department, ICMA Pakistan, Email: sameetahrafiqui99@gmail.com*
[2]*MPhil Scholar, Applied Economics Research Centre, University of Karachi, Email: qadir2034@gmail.com*
[3]*Faculty member department of economics shah Abdul Latif university khairpur Mirs, Email: ashiq.lashari@salu.edu.pk*
[4]*Mphill Scholar, Applied Economics Research Centre, University of Karachi, Email: shujaamj12@gmail.com*

ARTICLE INFO

Article History:

Received:	*January*	*15, 2026*
Revised:	*February*	*21, 2026*
Accepted:	*March*	*02, 2026*
Available Online:	*March*	*05, 2026*

Keywords:

Female labor force participation; Panel ARDL; Two-Stage Least Squares; cross-sectional dependence; CIPS unit root; economic development; fertility; education; health; digital access; selected Asian economies

Corresponding Author:
Sameetah Rafiqui
Email:
sameetahrafiqui99@gmail.com

OPEN ACCESS

ABSTRACT

This study examines the determinants of female labor force participation (FLFP) in 23 selected Asian economies over the period 2003–2024, focusing on economic, demographic, health, human capital, and technological factors. Using an unbalanced panel dataset, the analysis applies a Panel Autoregressive Distributed Lag (Panel ARDL) model to capture both short-run and long-run dynamics and employs Two-Stage Least Squares (2SLS) estimation as a robustness check for potential endogeneity. Preliminary tests reveal significant cross-sectional dependence across countries, as confirmed by the Pesaran CD test, while the Cross-Sectionally Augmented IPS (CIPS) unit root test indicates a mixed order of integration among the variables. These findings support the use of a Panel ARDL framework. The empirical results show that fertility and GDP per capita have negative long-run effects on FLFP, whereas female life expectancy and secondary education significantly increase women's participation. Internet usage has a negative long-run effect, suggesting that digital access alone does not automatically translate into labor market participation. The findings highlight the need for integrated policies focusing on reproductive health, female education, health improvement, digital skills, childcare support, and gender-inclusive employment opportunities. The study provides evidence-based insights for promoting inclusive growth and strengthening women's economic participation in selected Asian economies.

Introduction

Reducing gender gaps in access to, and participation in, the labour force is pivotal for economic progress and social justice. The participation of women in the economy is highly diverse in the developing Asian economies, owing to the disparate nature of the economy, social norms and demographic constraints. FLFP varied significantly across the region, with as high as 75.6 per cent in Cambodia in 2003 and as low as 10.9 per cent in Jordan. In some countries, like Israel and Turkey, more than 60 percent believe that anyone can claim it – others, like Pakistan and Jordan, were below 25 percent. The trends presented reflect the uneven progress of economic inclusion of women in the region. Demographic changes are only one of the factors affecting this variation. Economic development has not always resulted in an increase in female participation in some countries. However, in some countries higher levels of GDP per capita are accompanied by a decline or an unactionable level of FLFP, which indicates that an increase in GDP per capita is not enough to push gender-different economies to gender balanced labour markets (Klasen & Pieters, 2015). Delivering better outcomes in terms of births and women's health has not always eradicated the obstacles for women to access the labor market. Despite improved health indicators and reduced child mortality rates, there is a lack of participation of females in some countries. Although the access to digital technology has grown rapidly, Internet coverage is not linked to employment opportunities for girls and women (Verick, 2025). The patterns implied suggest that the decision on female participation in the labour market is an outcome of collective economic, demographic, health, human capital and technological factors in developing Asia. High fertility entails more care giving duties, which reduces the amount of time available for market work. Low education level puts a limit on women's access to formal jobs, and certain roles for women in households that are built into women's norms remain a barrier to the women's labor market (Rahmawan & Aisyah, 2023).

Four significant contributions to the literature have been made in the present study. It offers new regional data on 23 developing Asian economies for the last 20 years from 2003 to 2024, when the region experienced a high rate of demographic transition, a digital transformation, and unequal women's labour market outcomes. Second, this paper integrates the analysis of several determinants in one empirical framework, explaining differences in both economic development and fertility, female health, infant mortality, and secondary education as well as the use of the internet.Second, in contrast with a study that focuses on one determinant, this paper simultaneously analyzes differences in economic development, fertility, female health, infant mortality, secondary education, and internet usage in a unified empirical framework. Third, using Panel ARDL enables the researchers to capture both the long and short-run effects of changes in the variables measured in this study because the overall effect of a fertility, education, health, and digital access changes can be short term or it can take time. Finally, the study adds 2SLS estimation to the Panel ARDL results to check the potential endogeneity issues, such as the risk of reverse causality between the participation of women in labour and economic development.

Using the panel data of 23 developing economies in Asia, this study would examine these factors. The main determinants studied are: GDP per capita, TFT, female life expectancy, female infant mortality, secondary school enrollment, and internet usage. The method of analysis used is a Panel Autoregressive Distributed Lag (Panel-ARDL) model so as to differentiate both the long run from the short run relationships. The study also employs Two-Stage Least Squares (2SLS) estimation to control for the possible endogeneity as identified by the potential dependence between FLFP and GDP per capita. The results bear important policy implications. Economic growth doesn't necessarily lead to greater female employment. Policies need to focus on fertility, health, education and the inclusion agenda of digital. High fertility can lead to a suppression of participation, so reproductive health and family planning efforts are important. Training can bring up women's

skills and make them more job relevant, thereby gaining access to the labor market. Digital access, together with skills learning and flexible employment opportunities, can provide a decent job for women. The study offers a comprehensive analysis of the barriers to women's employment in Asia in terms of structural and institutional characteristics. The results are intended to guide decisions by policy makers looking at gender-inclusive development strategies and to help design strategies to support more women in the labour market.

The paper is divided into 5 different sections. Section 2 reviews the relevant literature and provides an overview of the most important papers discussing the factors influencing female labor force participation in developing countries. The empirical model and methodology of this study was described in Section 3, which outlined the data sources, the measurement of the variables, and the econometric methods used, such as the Two Stage Least Squares (2SLS) estimation approach and the Panel-ARDL estimation approach. The empirical results are presented in Section 4 which include descriptive statistics, cross sectional dependence, unit roots tests and the key finding from the estimation results. Lastly, concluding this study, Section 5 summarizes the main findings and gives policy recommendations based on the analysis.

Literature Review

However, the interaction among economic development, demographic transition, health outcome, human capital formation, technological access, and norms influence the level of female labor force participation (FLFP). There is not necessarily a linear association between the FLFP and economic development. Previous research on development tends to relate this with the concept of structural transformation and the so-called feminization U-hypothesis that suggests that demand for women may first decrease when the transition has shifted away from agriculture to elsewhere, and then increase once there has been a growth in education, services and formal employment. Recent studies, however, indicate that broadening employments opportunities for women can actually be a negative change in circumstances if existing growth is in dependable gender dominated fields, or social norms have remained unchanged and continue to limit women's mobility and employment options. In spite of economic advances in numerous parts of the world, female employment continues to be limited by the quality of employment, unpaid care work and institutional constraints, argues Verick (2025). Likewise, Bussolo et al. (2024) reveal that although gaps between men and women have narrowed over decades, gender social norms persistently remain significant in shaping women's agency, participation and choice in society and the labor market.

Demographic variables, specifically fertility, are one of the most important factors to influence FLFP. This means that if women have more children, they will spend increasingly more time on household and childcare duties which will leave less time for paid work. This link is particularly critical in unorganised child care settings that are predominantly handled by women in the contexts of developing economies with low levels of formal child care. By employing a panel ARDL method for the South Asian countries, Mishra and Sahoo (2025) conclude that there is significant long and short-run impact of reproductive health and women's empowerment on the participation of women in labor force. They conclude that greater family planning and reproductive health knowledge, and healthcare services to mothers, helps to address demographic issues and subsequently enhance the participation of women in the economy. Because fertility impacts not only on the quantity of children but also on the public cost of not paid care-work and the accessibility to the reproductive health services, it also influences FLFP.

Women's health status likewise fuels their labour market participation. Females' life expectancy is indicative of more general advances in health, nutrition, education and provision of public services. Women who feel they are healthier make themselves available for longer to education, skill acquisition and to the labor market. Conversely, poor health status and high infant mortality

could create caregiving demands and decrease women's ability to pursue paid employment. In low income settings, however, poor health conditions could also drive women's participation in work due to household income requirements. Thus, the anticipated role of health factors could also differ between women who have experienced empowerment and opportunity to women who have experienced economic distress and 'necessary' work.

The need for educating women is always mentioned as a major pathway to their labour market participation. Education for women leads to better chances at jobs, in formal work, earn income and bargaining power within the household. It may also decrease fertility and postpone marriage, thus indirectly facilitating labour market participation. Secondary education is especially critical in the Asian developing world as it is one of the least acceptable levels of education for entry into formal and semi-formal labour markets. An increasing number of studies continue to confirm the interaction between education and social norms as well as job opportunities. Even with the improvement in human capital, high fertility rates could challenge participation in the labor market where female education has increased while quality jobs apply to workers are limited.

Digital access has proven to be a new platform where women could access employment, entrepreneurship, skills acquisition and market information. Incorporating a Panel ARDL method, Ahmad et al. (2024) reveal that short-term and long-term digital economy indicators are positively correlated with female employment in the country. The impact of digital access, however, is not an automatic one. Women's access to a formal pathway into the digital work, safe online space, digital device, affordable connectivity or digital skills may not materialise with increased use of the internet if women's labour participation is a desired outcome. The policy discussions in recent years have also underscored the need for digital inclusion to go hand-in-hand with broadband access, skills building, financial inclusion and safeguarding against online risks. Hence, the benefits of using the internet does not ensure an increase of FLFP without opportunities in the labour market and gender-inclusive Digital policies.

On balance, the literature suggests that factors other than economic development are important for FLFP, and that several factors are related and reinforce each other. In addition to women's fertility and caring duties limiting their engagement with the market, the process of improving their educational attainment and health outcomes, as well as their digital access, can be complemented with enabling institutions and social norm shifts to promote women's labor force participation. While many of these determinants have been studied on their own, fewer studies look at the economic, demographic, health, education and digital determinants in a holistic multi-country Asian lens. The main objective of this study is to fill this gap by applying Panel ARDL to analyze both long-term and short-term factors of FLFP for 23 economies of Asia using 2SLS estimation to check the robustness of the main conclusions.

Model And Methodology

Based on a dataset covering the years 2003 to 2024, this research focuses on female labor force participation within 23 developing Asian countries. It formulates a model to include the economic, demographic, human capital, health, and technological variables. In the modeling, all variables are expressed in their natural logarithm form so that elasticities can be computed and the heteroscedasticity of the variables can be resolved. As part of the modeling, a Panel Autoregressive Distributed Lag (Panel ARDL) model is employed, and in the attempts to mitigate endogeneity, a Two-Stage Least Squares (2SLS) approach is utilized.

Model Specification

The empirical model aims to assess the impact of economic, demographic, health, technological, and human capital factors on FLFP in developing countries in Asia. The variables in the model, their anticipated signs, and the explanations for the signs are found in Table 1. Following the literature, the specification focuses on structural and demographic factors of women's labor market participation (Gaddis & Klasen, 2014; Klasen & Pieters, 2015).

The baseline empirical model uses natural logarithmic transformations of all variables to estimate the FLFP elasticities for the specified variables. The model will be expressed as follows.

$$\log(LFP)_{it} = \beta_o + \beta_1 \log(GDPPC)_{it} + \beta_2 \log(FRT)_{it} + \beta_3 \log(LEA)_{it} + \beta_4 \log(MRI)_{it} + \beta_5 \log(IUT)_{it} + \beta_6 \log(SES)_{it} + \varepsilon_{it} \quad (1)$$

Where:

LFP represents the female labor force participation rate, the dependent variable.

GDPPC captures economic development.

FRT proxies demographic burden through fertility.

LEA reflects improvements in women's health and longevity.

MRI measures the quality of public health systems and caregiving pressures.

IUT captures digital access and technology-driven empowerment.

SES represents human capital development through secondary education enrollment.

To capture both long-run and short-run dynamics, the study estimates the following error-correction representation of the Panel ARDL model in equation 2

$$\Delta \ln LFP_{it} = \varphi_i \left(\ln LFP_{i,t-1} - \theta_1 \ln GDPPC_{i,t-1} - \theta_2 \ln FRT_{i,t-1} - \theta_3 \ln LEA_{i,t-1} - \theta_4 \ln MRI_{i,t-1} - \theta_5 \ln IUT_{i,t-1} - \theta_6 \ln SES_{i,t-1}\right) + \sum \lambda_{ij} \Delta \ln LFP_{i,t-j} + \sum \delta_{ij} \Delta X_{i,t-j} + \mu_i + \varepsilon_{it} \quad (2)$$

where φi is the error correction coefficient, measuring the speed of adjustment for female labor force participation toward equilibrium in the long run after a perturbation in the short run. A negative, statistically significant error correction term is indicative of a long-run relationship among the variables that is stable. For each variable, the expected signs are in agreement with prior empirical studies and theoretical predictions as presented in Table 1. Higher levels of fertility and infant mortality are believed to lower women's labor participation. In contrast, longer female life expectancy, greater internet usage, secondary education enrollment, and higher levels of economic development are believed to enhance FLFP. Coefficients estimated through a logarithmic scale can be interpreted as elasticities, thus, enabling a better understanding of the proportional impact of each determinant on female labor participation.

Table 1: Description of Variables and Expected Signs

Variable	Description	Expected Sign	Explanation
LFP	Labor force participation rate, female (% of female population ages 15+) (modeled ILO estimate)	N/A	Dependent Variable

GDPPC	GDP per capita (constant 2015 US$)	+	Economic growth creates non-agricultural and service-sector jobs that attract female workers, improving participation (Klasen & Pieters, 2015).
FRT	Fertility rate, total (births per woman)	-	Higher fertility rates increase household and childcare duties, reducing time available for market work (Ahn & Mira, 2002).
LEA	Life expectancy at birth, female (years)	+	Longer female life expectancy reflects improved health and education, enabling greater lifetime labor participation (Spence & Leipziger, 2010)
MRI	Mortality rate, infant, female (per 1,000 live births)	-	High infant mortality indicates poor health conditions and care burdens, discourage women's labor force participation (UNDP, 2022).
IUT	Individuals using the Internet (% of population)	+	Internet use enhances access to online work, education, and market information, empowering women's economic participation (Ahmad et al., 2024).
SES	School enrollment, secondary (% gross)	+	Higher female secondary education increases skills, employability, and access to formal jobs, leading to higher FLFP. Education improves bargaining power and labor market readiness (Rahmawan & Aisyah, 2023).

Note: Data for all variables were extracted from the World Development Indicators, World Bank database. Internet usage data were cross-checked with World Bank ICT indicators

Data Coverage and Transformation

The empirical analysis of this paper aims to use an unbalanced panel dataset from 23 developing Asian economies from 2003 to 2024. The sample comprises Bahrain, Bangladesh, Brunei Darussalam, Cambodia, China, Fiji, India, Indonesia, Israel, Jordan, Kuwait, Lao PDR, Malaysia, Mongolia, Nepal, Oman, Pakistan, the Philippines, Qatar, Samoa, the Syrian Arab Republic, Thailand, and Türkiye . The countries included in the selection are solely as a result of the consistency in the source of the variables used in the model across all the countries. The geographical coverage as included reflects different economic structures in Asia, namely South Asia, Southeast Asia and certain parts of East and Central Asia and hence extends beyond regional conclusions about the determinants of female labour force participation (FLFP).

Data on the dependent variable and all the explanatory variables were extracted mainly from World Development Indicators (WDI) database and presented annually. IUT was also obtained from the Global ICT dataset from the World Bank, to provide latest and most accurate ICT connectivity data. Table 1 presents the definitions, implications and theory behind each variable included in the analysis. All of the variables were treated as natural logarithms in order to allow various elasticities to be calculated and for comparability between countries. It enables to address some skewness, heteroscedasticity, and interpret the coefficients as percentage changes to provide more economical meaning. For the data before estimation, descriptive statistics were performed to evaluate data behavior; and graphical trend analysis was performed to assess the presence of structural bends and anomalies.

Formal unit root tests were applied since macroeconomic and demographic indicators might not have same order of integration. Mixed integration orders; that is variables being a mixture of I(0) and I(1) conditions justify the use of Panel Autoregressive Distributed Lag (Panel ARDL) framework empirically. The dataset was also analyzed for the presence of cross sectional dependence, which is a common property across the regional panel datasets, stemming from the presence of common shocks as well as economic linkages and policy spillovers. Overall, the data has enough intra-sample variation for both short- and long-run estimates of the effects of economic, demographic, health, human capital, and the digital determinants of FLFP in developing Asian economies.

Estimation Strategy

The empirical analysis has been carried out using a Panel Autoregressive Distributed Lag (Panel ARDL) approach that enables capturing both the short-run and long-run dynamics, in addition to the use of panel's Two-Stage Least Squares (2SLS) estimator to deal with the possible problems of endogeneity. Their complementary use, in turn strengthens the results and strengthens the confidence in the level of estimated relationships that are perceived between female labor force participation (FLFP) and its determinants. The mixed level of integration of the variables, I(0) and I(1), is particularly suitable for the application of the Panel ARDL methodology. The findings indicate that the ARDL framework can be used because of the mixed integration order revealed by the unit root tests reported in Section 4.3. The computation of the method can leave short-run dynamics different across countries, while the long-run coefficients can be kept homogeneous; this method is suitable for studies involving multi-country settings and a time series analysis of structural relations. The Pooled Mean Group (PMG) estimator is used as the preferred specification as it provides an effective compromise between countering country-specific movements and a common long-run equilibrium relationship. Furthermore, the study uses two other estimators, the Mean Group (MG) and Dynamic Fixed Effects (DFE) to confirm the robustness of the results. Many similar empirical studies have been conducted using the PMG estimator with interests in understanding the linkage of fertility to female participation in the labor market in Asian economies have been carried out by (Nazah et al., 2021) applying panel ARDL approach for investigation. The methodological ground work on ARDL estimation on heterogeneous panel is well-established from the seminal work of (Pesaran & Shin, 1999).

To address the potential common country effects, especially for multi-country panel datasets, the study first conducts a Pesaran cross sectional dependence test to assess whether there is any CD problem in the variables. In some cases, countries might be interdependent due to common macroeconomic conditions, trade, technology diffusion and/or policy spillovers, and the Pesaran CD test is useful in detecting the presence of cross-sectional dependence in panel data (Pesaran, 2004). Cross-sectional dependence exists in all of the variables with results appearing in Section 4.2. Cross-sectional dependence finding suggests using the Cross-Sectionally Augmented IPS (CIPS) unit root test from Pesaran (2007). The advantage of the CIPS test in this context is its ability to capture cross-country dependence by adding up cross-sectional means to the standard IPS, which represents a popular approach in empirical labor economics. In the case of common shocks this accommodates the evaluation of the respective stationarity properties of the variables more reliably. In section 4.3 the results of the CIPS analysis show an mixed order of integration - some variables are stationary both in level and after one difference, while others are stationary only when taking first differences. This makes the use of Panel ARDL feasible if all variables are integrated of order I(0) and I(1) with no variable integrated of order I(2) or more. The study highlights that the Panel ARDL technique will note the dynamic short-run and long-run relationship between variables while the standard PMG estimation approach might not rule out all the forms of cross-sectional dependence completely. Hence, care must be taken with the results

and also another robustness check is made using the 2SLS estimation. Longer and more balanced data sets could be used in future research to apply CS-ARDL or DCCE estimators to extend the analysis.

To overcome the possible endogeneity concern, in the second stage of the empirical strategy Two-Stage Least Squares (2SLS) estimation is used, especially with respect to the problem with female labour force participation and economic development. The endogenous nature of GDP per capita is related to the potential of growth provided by participation of women in the labor market.The endogenous nature of GDP per capita is linked with the growth potential of women's participation in the labor market, e.g. by contributing to the growth of the labor force, household income and productivity. To counteract this simultaneity concern the lagged version of GDP per capita has been employed as an instrument for the current GDP per capita. Past GDP per capita levels have been used for this purpose because there is strong correlation over time between past and current levels of economic development, but it is unlikely that the condition of the current female labour force is directly determined by the current shocks. Stage 1 involves regression of the current GDP per capita on the GDP per capita one year ago and other exogenous control variables. The second steps use the GDP per capita prediction in the FLFP equation. This is a vehicle to separate effects of exogenous component of economic activity from the economic development outcomes of the Panels ARDL and gives a robustness check of the results of the Panel ARDL. The methodological approach employed in this study has distinctive merits compared to previous studies which mainly used static estimators or country specific analysis (Kaur et al., 2021; Rahmawan & Aisyah, 2024). The Panel ARDL method provides an explicit separation between the short run and the long-run period and the short run and long run adjustment periods, and the 2SLS method gives a formidable way to overcome the problem of endogeneity. They yield more reliable, interpretable and policy-relevant results and, acting together, make the present analysis methodologically more sound and complete than previous analyses within the field.

Empirical Findings

This section outlines the study of female labor force participation (FLFP) in 23 developing Asian countries from 2003 to 2024. First, descriptive statistics present an overview of the data. This is followed by a cross-sectional dependence and stationarity assessment, which will support using the Panel ARDL approach. The Panel ARDL results are presented and interpreted to capture the long and short run impacts of the economic, demographic, health, and human capital and technology factors on FLFP. Lastly, it will address FLFP endogeneity issues and present the stability of the findings.

Descriptive Statistics

Table 2 shows each variable's mean and standard deviation. LOG(LFP), the dependent variable, had a mean of 3.676 and a standard deviation of 0.461. This indicates a moderate range of female labor force participation. Among the explanatory variables, LOG(GDPPC) had a mean of 8.564 and a large standard deviation of 1.294, reflecting income disparities, while LOG(FRT) had a mean of 0.909 and a smaller standard deviation of 0.293, which indicates a more even distribution of populations. The indicators of health and human capital show a lack of considerable variation. Women’s life expectancy had a mean of 4.313 (SD = 0.070) and Infant mortality had a mean of 2.671 and a higher SD of 0.765. This shows health outcomes are uneven. Variations were also found in technology and education. LOG(IUT) had a mean of 3.198 and SD of 1.301 and The mean of secondary school was 4.340 and SD = 0.316 which shows differences in school attainment and digital disparities. The mean and standard deviations of the items show substantial disparities and a well-developed basis for the key analysis of economic, demographic, health, human capital, and technological factors.

Table 2: Descriptive Analysis

Variable	Mean	Median	Maximum	Minimum	Std. Dev.	Obs.
LOG(LFP)	3.6758	3.8181	4.4048	2.3843	0.4606	506
LOG(GDPPC)	8.5632	8.3437	11.3097	6.3461	1.2939	506
LOG(FRT)	0.9090	0.9169	1.5880	-0.0010	0.2933	506
LOG(LEA)	4.3133	4.3227	4.4485	4.1224	0.0703	506
LOG(MRI)	2.6706	2.6672	4.3412	0.9163	0.7646	506
LOG(IUT)	3.1977	3.5300	4.6052	-1.8079	1.3009	506
LOG(SES)	4.3402	4.4370	4.8366	2.9913	0.3158	506

Source: Authors Estimation

Cross Sectional Dependence Test

Table 3 presents the findings from the Pesaran cross-sectional dependence (CD) test for the variables we analyze. The test assesses the correlation of country residuals, which is crucial for panel data, especially for many country cases. The results show, at the 1% level, that all variables exhibit significant cross-section dependence. For LOG(LFP), LOG(GDPPC), LOG(FRT), LOG(LEA), LOG(MRI), LOG(IUT), and LOG(SES), the CD statistics are extremely significant ($p = 0.0000$) and indicate that shocks/structural changes for the country in question are likely to affect the countries in the panel. The cross-section dependence and interconnectedness of the selected economies endorses the application of the second-generation unit root tests and implies that the principal estimation results should be interpreted carefully as the influence of global and regional common shocks on the panel is highly likely.

Table 3: Pesaran Cross-Sectionally Dependence Test

Variable	Statistic	d.f.	Prob.
LOG(LFP)	5.0276	253	0.0000
LOG(GDPPC)	20.4567	253	0.0000
LOG(FRT)	47.8894	253	0.0000
LOG(LEA)	39.9006	253	0.0000
LOG(MRI)	32.8692	253	0.0000
LOG(IUT)	70.7936	253	0.0000
LOG(SES)	29.1267	253	0.0000

* Significant at 1%, ** Significant at 5%, *** Significant at 10%
Source: Authors Calculations

Stationarity Analysis

Before estimating the Panel ARDL model, we should check for the stationarity of the variables with cross-sectional dependence. Table 4 contains the Cross-Sectionally augmented IPS (CIPS) unit root test results with an individual unit in (C) and with a trend in (C+T). The results exhibit an assortment of integration orders for the variables. LOG(GDPPC), LOG(LEA), LOG(IUT), and LOG(SES) are stationary at level, I(0). LOG(LFP), LOG(FRT), and LOG(MRI) are stationary in the first differencing, I(1). Given the mixed integration of I(0) and I(1) variables, the Panel ARDL approach is appropriate since this approach allows the analysis of the variables with different levels of integration, I(0) and I(1), and the model provides the estimations for both the short-run and long-run relationships. The results also signify that the variables are not integrated of order two, I(2), which is an important condition that ensures the validity of the ARDL estimations. This

analysis brings the empirical basis to estimate the long-run and short-run associations for the female labor force participation in developing Asian economies.

Table 4: Cross-Sectional IPS (CIPS) Unit Root Test

Variable	I(0)		I(1)		Results
	C	C+T	C	C+T	
LOG(LFP)	-2.0639	-2.1285	-3.6392*	-3.8385*	I(1)
LOG(GDPPC)	-2.2827**	-2.7818**			I(0)
LOG(FRT)	-2.0636	-1.9438	-2.3279**	-2.9644*	I(1)
LOG(LEA)	-2.3459**	-2.1341***			I(0)
LOG(MRI)	-1.4548	-2.1852	-2.3681**	-3.2389*	I(1)
LOG(IUT)	-2.5627*	-2.9248*			I(0)
LOG(SES)	-2.6967*	-2.8934*			I(0)

* Significant at 1%, ** Significant at 5%, *** Significant at 10%
Source: Authors Calculations

Empirical Findings

The Panel-ARDL estimation results, presented in Table 5, capture both long-run and short-run determinants of female labor force participation (FLFP) across 23 developing Asian economies. The model exhibits a high goodness of fit, indicating that the selected explanatory variables account for a substantial portion of the variation in FLFP.

Table 5: Panel Autoregressive Distributed Lag (Panel-ARDL) Results

Variable	Coefficient	Std. Error	T Value
LOG(GDPPC)	-0.3018*	0.0468	-6.4459
LOG(FRT)	-1.1716*	0.1778	-6.5882
LOG(LEA)	2.2103*	0.5629	3.9266
LOG(MRI)	0.4810*	0.0971	4.9547
LOG(IUT)	-0.1478*	0.0248	-5.9494
LOG(SES)	0.2687*	0.0689	3.8978
Short Run Equation			
ECT	-0.1139**	0.0450	-2.5318
DLOG(GDPPC)	0.0526	0.0868	0.6060
DLOG(GDPPC(-1))	-0.0485	0.1313	-0.3691
DLOG(FRT)	0.0812	0.2745	0.2957
DLOG(FRT(-1))	0.0734	0.2439	0.3008
DLOG(LEA)	0.3796	0.3608	1.0519
DLOG(LEA(-1))	-0.3889	0.2720	-1.4297
DLOG(MRI)	-0.0723	0.1250	-0.5787
DLOG(MRI(-1))	-0.2809	0.3638	-0.7721
DLOG(IUT)	0.0284	0.0351	0.8076
DLOG(IUT(-1))	0.0452***	0.0240	1.8869
DLOG(SES)	0.0046	0.1655	0.0276
DLOG(SES(-1))	-0.2792	0.2023	-1.3802
C	-0.4927**	0.2092	-2.3549
R-squared	0.9762		
Adjusted R-squared	0.9748		
F-statistic [Prob.]	700.0572 [0.0000]		

Durbin-Watson stat	0.2192

* Significant at 1%, ** Significant at 5%, *** Significant at 10%
Source: Authors Calculations

The long-run results reveal that the economic development shows negative statistically significant effect on women's labor force participation. In the long run, for every 1 percent increase in GDP per capita, FLFP decreases by 0.3018 percent. This finding is not consistent with the pattern of increasing employment for women over economic growth as would conventional wisdom predict, but with the feminization U-shaped hypothesis as presented by Gaddis and Klasen (2014) and Klasen & Pieters (2015), which suggests that participation may start to fall during structural transformation and begin to rise at higher levels of economic development. In a number of emerging Asian economies, economic growth can take place in economic activity that is capital-intensive, sex-segregated and/or informal, and thereby not sufficiently accommodate female labor. An increase in household income could also reduce the economic need for women to engage in low paid jobs, especially when social norms remain to be against allowing women mobility and paid employment (Bussolo et al., 2024; Verick, 2025). Thus, the negative per capita GDP coefficient does not mean a growth 'bad' for women. Instead it suggests the need to have gender-inclusive job creation, safer mobility, access to childcare services and to jobs in the formal sector along with growth.

FLFP is strongly and statistically negatively related to fertility in the long term. The -1.1716 coefficient implies that for every 1 percentage point increase in fertility, there is a decline in female labor force participation of about 1.17 percentage points. This outcome is significant for the economic division of care between women and men as it directly adds to women's care duties in the informal, non-payable sector, and decreases the hours women can spend in paid work. The result is akin to the results from the literatures on time allocation theory of labor supply which argue that women with higher child care demands are less likely to be actively engaged in the labor force. Previous as well as recent research also corroborates that high fertility and reproductive concerns hinder women's labour market participation, especially in low- and middle-income countries where publicly provided daycare and pre-school facilities are underdeveloped (Ahn & Mira, 2002; Bloom et al., 2009; Mishra & Sahoo, 2025; Sunday et al., 2024). The discovery highlights the need for reproductive health services, family planning, maternity assistance, and childcare policies as key in enhancing the economic doings of women.

Female life expectancy has a positive and statistically significant long-run effect on FLFP. An increase in the health and life expectancy of women is correlated with an increase in labour participation by 2.2103. This outcome is theoretically consistent as better health leads to increased capacity in women to obtain education, engage in productive activities and work for a longer time. Female life expectancy could also reflect that which included enhanced nutritional status, improved access to health and social services, public education and services and enhanced labor market preparedness of women, due to increased and better human capital. Rahman and Alam (2021) demonstrate that an increase in female education, public health spending, and provision of basic services are strongly associated with improved health outcomes for women. Thus, the increase in life expectancy offers a double benefit: not just in the sense of being a welfare gain, but also as a pathway to greater involvement of women in the economy.

The LR coefficient of the infant mortality is positive and is statistically significant, the opposite of what was expected. There is a negative expectation about this relationship, with high infant mortalities being interpreted as low health status, low public services and high caregiver responsibilities, potentially limiting women's engagement in the labor market (UNDP, 2022). But studies can have a positive coefficient that might be due to labor participation as a result of distress

or factors related to poverty. In vulnerable economies, in a place where women's role is more dependent than men, they might work to earn income because of economic rather than empowerment. This interpretation aligns with the notion that as a developing economy's income situation tightens, unemployment decreases, which can be attributed to informal employment or survival type work, activities that the female may occasionally engage in as a coping strategy (Verick, 2025). So caution should be used in interpreting this result. Rather than implying that infant mortality is bettering the position of women in labour force participation, it could be an indicator that women have better access to the labour force than in good quality or formal jobs, and are suffering from adverse health and welfare conditions as well.

The long term impact on FLFP using the Internet is negative and statistically significant. This discovery indicates that internet connectivity is not sufficient to lead to participation in the labor market. While digital technologies can enhance information access, online employment, entrepreneurship, and flexible working, the effect of these depends on the availability of digital skills among women, affordable devices, safe Internet access and financial inclusion, as well as platforms enabling the availability of income. Ahmad et al. (2024) demonstrates how the digital economy can contribute to women's employment, and that the benefits rely on the more extensive digital economy and linkages within the labour market. In emerging developing Asian economies, Internet use might be limited to the use of communication and education as well as consumption instead of being used for productive employment. Social norms, worries about online safety, skill deficits, and the lack of formal digital jobs could also pose a barrier to opportunities for women to monetize connectivity into jobs (Bussolo et al., 2024; Verick, 2025). Hence, negative co-efficient indicates the importance of augmenting availment of digital services with digital skills, employment matching, freelancing facilitation, cyber protection and women centric entrepreneurship courses.

M mentioned that secondary school enrolment is positively and significantly related to FLFP. Secondary enrollment is associated with 0.2687 percent increase in female labor force participation for every one percent increase in secondary enrollment. This reaffirms the education as one of the most important ways of human capital that facilitates women to have better chances of being employable and productive, bargaining power and accessing formal labor market. Indirectly, education contributes to participation by postponing marriage and lowering birth rates and the power of women in decision making processes in families. Engaging in education equips women with the skills they need to participate in the formal or semi-formal sector of the labor market and this has been shown to be one of the factors that are consistent across various studies (Kaur et al., 2021; Rahmawan & Aisyah, 2024; Tansel, 2002). This leaves buying up women's education as an essential tool to promote long-run labour participation as its coefficient is positive.

The short-run results show that, in most cases, the first-differenced variables are not statistically significant, meaning that changes in economic development, fertility, health, education, and digital access do not first impact female labor force participation. It is economically rational that women's participation in the labor market is the result of slow-moving and unchangeable structural and household constraints. For example, the impact of schooling has a delayed effect on educational outcomes in the labor market due to the necessity of educational completion, the development of marketable skills, the positioning, the discovery of a job that is a good fit, and the labor market positioning and the availability of the household to support participation. The effect of fertility has similar household constraints with the availability of child care, the household composition, the availability of household and maternity labor support, and the support and the acceptance of women participating in the labor market. The presence of other delayed constraints supports the notion that female labor force participation has a gradual response to structural changes and does

not immediately respond to the annual changes in the economy or the demographic indicators (Klasen & Pieters, 2015; Verick, 2025).

The error correction term being negative and significant relates to the existence of a long-run relationship of the variables. Having an estimated coefficient of -0.1139, it can be derived that 11.39 percent of the disequilibrium is corrected per annum. This shows that the process to attain equilibrium is prolonged. Given the factors that influence women's labor force participation, the prolonged process is acceptable. Factors that affect labor market participation are norms, educational attainment, fertility, caregiving, and labor market dynamics. Given this, the policy initiatives that are likely to impact the labor market are education, health, fertility, and policies that improve digital and transportation access. These policy initiatives are likely to impact women's labor force participation only after a prolonged period. Among the variables, lagged internet usage is positively and weakly significant at the 10 percent level. This suggests that digital access may positively impact women's labor force participation, but that impact is likely to occur after a prolonged period. The positive effect is likely to occur when women access the internet and subsequently engage in various forms of positive activities such as online learning, job searching, freelancing, starting a business, or engaging in remote work. Given that lagged internet use is weakly significant, the positive impact is not likely to occur immediately and is only likely to occur once digital access is combined with other factors such as online safety, digital literacy, employment linkage, and income-generating opportunities.

Sensitivity and Robustness Analysis

Geographically, the findings from the panel ARDL in terms of cross-sectional dependencies, endogeneity, and cointegration, are largely corroborated by the results derived from the application of 2SLS. The results show that, contrary to the claim that the relationships among the developing Asian economies are positive, the relationship among the developing economies of the Asian countries shows that the relationship is not positive. Considering that growth is not good if the growth is not positive and there is capital growth, there are likely not to be positive improvements and positive developments in the growth of the sector that is largely male dominated. Fertility remains negative and significant. This essentially posits that the demographic burden is a persistent constraint on the supply of women's labor. This creates a fresh demand to address reproductive health, and family planning, and to provide child care services, and flexible working services. The positive and significant variables of female life-expectancy and female secondary school enrollment suggest that improved health and education are associated with higher levels of female labor force participation. The positive but weak and modest relationship of female infant mortality indicates no positive relationships and possibly increased negative relationships among female infant mortality and labor force participation. The negative and significant relationship between female internet usage and labor force participation indicates that there is no positive relationship among the two and that the internet is largely insignificant in female labor force participation. In general, the 2SLS output essentially confirms the relationships presented in the panel ARDL output.

Table 6: Two Stage Least Square (TSLS) Results

Variable	Coefficient	Std. Error	T-Statistic
LOG(GDPPC)	-0.0729**	0.0285	-2.5635
LOG(FRT)	-0.0765**	0.0333	-2.2959
LOG(LEA)	1.1134*	0.2592	4.2951
LOG(MRI)	0.0548***	0.0312	1.7578
LOG(IUT)	-0.0175*	0.0063	-2.8062

LOG(SES)	0.1318*	0.0368	3.5780
C	-0.8019	1.1565	-0.6934
R-squared	0.9762		
Adjusted R-squared	0.9748		
F-statistic [Prob.]	700.0572 [0.0000]		
Durbin-Watson stat	0.2192		

* Significant at 1%, ** Significant at 5%, *** Significant at 10%
Source: Authors Calculations
Note: GDP per capita is treated as potentially endogenous. Its lagged value is used as an instrument in the 2SLS estimation. The results should be interpreted as a robustness check for the direction and significance of the long-run relationships.
Due to data limitations and the absence of extensive instrument diagnostics, the 2SLS results are treated as a robustness check rather than a full causal identification strategy.

Although the Durbin-Watson statistic suggests possible serial correlation, the dynamic specification of the Panel ARDL model and the inclusion of the error correction term help capture persistence in FLFP. Nevertheless, the results should be interpreted with caution, and future research may apply robust dynamic common correlated effects estimators.

Conclusion And Policy Recommendations

The aim of this study was to analyze the main determinants of female workforce participation in the Asian economies, from 2003 to 2024, centering on the factors of economic development, fertility, health of women, infant mortality rates, internet use and secondary education. The analysis of the results from model ARDL and 2SLS estimation by considering the long run elasticity period shows that female fertility and female GDP growth have negative effects on the female labour force participation ratio, while female life expectancy and the secondary education ratio have positive effects. There is also a negative long-run impact for those using the Internet, which indicates simply having access to the Internet doesn't ensure job opportunities. The inference drawn from the positive coefficient of infant mortality should be taken with a pinch of salt since involvement of parents in school may accompany distress and not empowerment. In conclusion the results indicate that there are structural, demographic, health, educational, and digital factors, in addition to economic growth, that shape the participation of women in the labor force.

The study recommends that the governments should first start addressing fertility-related constraints by enhancing access to reproductive health services, family planning, maternal health services, and awareness programmes. Such policies need to be complemented with childcare provision, maternity protection, flexible working conditions and daycare systems in the workplace, to keep women in the job market. Secondly, investments should be increased in female education, especially secondary, to build capacity in female teachers. But education policies should go further than enrollment and include vocational education, employable skills, digital skills, career counselling and school-to-work transition programmes. This is critical as it enhances the ways in which women can access to formal jobs, enhance productivity, and involve themselves more in the economic activities.

Thirdly, the policies around health should be connected to women's economic participation. Gaining in women's life expectancy paves the way for women's participation in the labour force by positively impacting their ability to study, work and continue active in their economy for longer periods. Thus the governments must put investments into preventive health and welfare of women,

maternal services, nutrition and protection of the health of women in the workplace. The positive association between infant mortality and a FLFP must also be viewed with some caution since it could be interpreted as reflecting poverty driven employment or informal employment, not directly related to the improvement of employment outcomes. Fourth, digital inclusion shall be employment oriented. The negative long-run impact of internet use demonstrates that Internet access is not sufficient without:i) digital skills, ii) affordable devices for accessing the Internet, iii) reliable Internet connections, iv) online safety, and, v) income-generating opportunities. Digital training, freelancing support platforms, e-commerce platforms and platforms for remote work that are geared towards women can transform digital access into successful labour market engagement for women. Last, but not least, other strategies for economic growth should become more gender-sensitive. Governments should boost sectors where female workforce can be integrated, such as education and health, services, light manufacturing, care economy and women entrepreneur and information technology, as GDP per capita is not automatically an increase of the female workforce. Women's employment requires supportive policies – e.g. safe transport, anti-harassment measures, equal pay, formal contracts, social protection of informal and home based workers, etc. – both in terms of the number and the quality of women's employment.

References

1. Ahmad, R., Sharif, F., Ahmad, S., Gul, A., & Zarnigar, A. (2024). Does the digital economy improve female employment? A cross-country panel data analysis. Heliyon, 10, e33535. https://doi.org/10.1016/j.heliyon.2024.e33535
2. Ahn, N., & Mira, P. (2002). A note on the changing relationship between fertility and female employment rates in developed countries. Journal of Population Economics, 15(4), 667–682. https://doi.org/10.1007/s001480100078
3. Bloom, D. E., Canning, D., Fink, G., & Finlay, J. E. (2009). Fertility, female labor force participation, and the demographic dividend. Journal of Economic Growth, 14(2), 79–101. https://doi.org/10.1007/s10887-009-9039-9
4. Bussolo, M., Ezebuihe, J. A., Muñoz Boudet, A. M., Poupakis, S., Rahman, T., & Sarma, N. (2024). Social norms and gender disparities with a focus on female labor force participation in South Asia. The World Bank Research Observer, 39(1), 124–158. https://doi.org/10.1093/wbro/lkad010
5. Gaddis, I., & Klasen, S. (2014). Economic development, structural change, and women's labor force participation: A reexamination of the feminization U hypothesis. Journal of Population Economics, 27(3), 639–681. https://doi.org/10.1007/s00148-013-0488-2
6. Kaur, P., Gujrati, R., & Uygun, H. (2021). Trace the relationship between digital technologies and female labor force participation in India. Business Studies Journal, 13(5S), 1–8.
7. Klasen, S., & Pieters, J. (2015). What explains the stagnation of female labor force participation in urban India? The World Bank Economic Review, 29(3), 449–478. https://doi.org/10.1093/wber/lhv003
8. Mishra, S., & Sahoo, D. (2025). Impact of women's reproductive health and empowerment on female labour force participation. Journal for Labour Market Research, 59, Article 24. https://doi.org/10.1186/s12651-025-00414-0
9. Nazah, N., Duasa, J., & Arifin, M. I. (2021). Fertility and female labor force participation in Asian countries: Panel ARDL approach. Jurnal Ekonomi & Studi Pembangunan, 22(2), 272–288. https://journal.umy.ac.id/index.php/esp/article/view/11142
10. Pal, S., & Chaudhuri, S. (2020). Falling female labour force participation: An analysis of selected countries. HAL Post-Print, hal-05299375. https://ideas.repec.org/p/hal/journl/hal-05299375.html

11. Pesaran, M. H. (2004). General diagnostic tests for cross section dependence in panels. CESifo Working Paper No. 1229.
12. Pesaran, M. H. (2007). A simple panel unit root test in the presence of cross-section dependence. Journal of Applied Econometrics, 22(2), 265–312. https://doi.org/10.1002/jae.951
13. Pesaran, M. H., & Shin, Y. (1999). An autoregressive distributed-lag modelling approach to cointegration analysis. In S. Strøm (Ed.), Econometrics and economic theory in the 20th century: The Ragnar Frisch Centennial Symposium (pp. 371–413). Cambridge University Press. https://doi.org/10.1017/CCOL521633230.011
14. Rahman, M. M., & Alam, K. (2021). The role of access to electricity, female education, and public health expenditure on female health outcomes: Evidence from SAARC-ASEAN countries. BMC Women's Health, 21, Article 383. https://doi.org/10.1186/s12905-021-01520-0
15. Rahmawan, F. A. N., & Aisyah, S. (2024). Examining determinants of women's labor participation rate in developing Asian countries. Journal of Enterprise and Development, 6(1), 259–269. https://doi.org/10.20414/jed.v6i1.9542
16. Spence, M., & Leipziger, D. (Eds.). (2010). Globalization and growth: Implications for a post-crisis world. World Bank.
17. Sunday, A. L., Lihawa, R. M., & Mkuna, E. (2024). The effect of fertility on female labor force participation in Tanzania. PLOS ONE, 19(1), e0292122. https://doi.org/10.1371/journal.pone.0292122
18. Tansel, A. (2002). Determinants of school attainment of boys and girls in Turkey: Individual, household and community factors. Economics of Education Review, 21(5), 455–470. https://doi.org/10.1016/S0272-7757(01)00028-0
19. UNCTAD. (2025). World Economic Situation and Prospects 2025. United Nations Conference on Trade and Development. https://unctad.org/publication/world-economic-situation-and-prospects-2025
20. United Nations Development Programme. (2022). Human Development Report 2021/2022: Uncertain Times, Unsettled Lives: Shaping Our Future in a Transforming World. UNDP. https://hdr.undp.org/content/human-development-report-2021-22
21. Verick, S. (2025). Female labor force participation and development. IZA World of Labor, 87. https://doi.org/10.15185/izawol.87.v3
22. World Bank. (2024). South Asia Development Update, October 2024: Women, Jobs and Growth. World Bank.
23. World Bank. (2025). World Development Indicators. World Bank.