International Journal of Humanities and Social Science Research
www.socialsciencejournal.in
E-ISSN: 2455-2070
Received: 05-10-2026, Accepted: 04-11-2026, Published: 19-11-2026
Volume 12, Issue 4, 2026, Page No. 159-168

Revisiting the female labour–growth nexus in India: Evidence from State-Level Panel Data

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DOI: https://doi.org/10.66856/ijhssr.2026.12.4.12379

Abstract
This study examines the nexus between female labour force participation rate (FLFPR) and economic growth across 27 Indian states over the period 2017–18 to 2022–23. While India has experienced sustained economic growth, female labour force participation has remained persistently low and uneven across states, raising important questions regarding the gender–growth nexus. Using state-level panel data, the study first analyses national trends and inter-state as well as inter-regional disparities in FLFPR. The empirical investigation proceeds through both static and dynamic panel frameworks. While the static fixed effects model fails to establish a statistically significant relationship between FLFPR and growth, the dynamic panel estimation using the Arellano–Bond difference GMM approach reveals a statistically significant U-shaped relationship between FLFPR and real Net State Domestic Product (NSDP) growth. The findings indicate that at lower levels of female participation, increase in FLFPR may not immediately translate into growth gains; however, beyond a threshold level of approximately 39 percent, higher participation contributes positively to economic growth. The results also highlight the significant role of total fertility rate in influencing growth dynamics. Diagnostic tests confirm the validity of instruments and absence of second-order serial correlation. The study underscores that the growth effects of female labour participation are dynamic and non-linear, suggesting that policies must focus not only on increasing participation rates but also on improving job quality, productivity, and structural transformation to realise sustainable and inclusive growth.

Keywords: Female Labour Force Participation Rate (FLFPR), Economic Growth, Net State Domestic Product

Introduction

The classical production function exhibits direct functional relationship between total output of an economy and size of labour along with capital and level of technology. The neo classical economists also emphasized the role of labour in their production function. Again, in the endogenous growth models labour is not just a quantitative element but it is a facilitator of long-term growth through human capital accumulation, innovation and learning by doing. Thus, labour has always been recognized as an important element of economic growth both quantitatively as well as qualitatively. The quantitative role of labour in total output or economic growth of an economy can be assessed through its labour force participation rate (LFPR). LFPR is defined as the proportion of the population ages 15 and older that is economically active. A higher labour participation rate reflects effective labour supply and improved resource utilisation, particularly in labour abundant countries. The LFPR and economic growth share a bidirectional and mutually reinforcing relationship. A higher LFPR expands the productive capacity of the economy thereby fostering economic growth. Conversely, higher economic growth generates greater employment opportunities, which in turn encourages higher labour force participation. Various studies show that there exists long run causality between labour force participation rate and real GDP (Yakubu *et al*., 2020, Shahid, 2014, Romanus &Nkechi, 2024) [23, 24, 27]

Building on this theoretical and empirical understanding of the labour–growth nexus, it is essential to recognise that aggregate labour force participation encompasses both male as well as female labour force participation. However, measures of aggregate LFPR may not always reflect substantial gender disparities in labour market participation, particularly in developing countries like India. In the Indian context, the relationship between labour force participation and economic growth draws considerable attention due to persistently low female labour force participation rates despite sustained economic growth. While India has experienced periods of high GDP growth, female labour force participation has either stagnated or declined, indicating a disconnect between aggregate growth and women's economic engagement (Chaudhary & Verick, 2014; Klasen & Pieters, 2015) [7, 16]. According to recent estimates, India's FLFPR is among the lowest in the world (41.7 per-cent, PLFS,2023-24) reflecting deep-rooted structural and socio-cultural constraints. Given that women constitute nearly half of India's working-age population, low female labour force participation represents a significant underutilisation of human resources, capping the economy's productive potential. Some studies suggest that higher female labour participation in India can substantially raise output, productivity, and household welfare while promoting more inclusive growth (Esteve-Volart, 2004; Cuberes & Teignier, 2011) [8, 11]. The importance of higher female labour force participation rate in India can be realized from the fact that female employment contributes to higher household incomes, better health and education outcomes, and intergenerational productivity gains. Moreover, from a growth perspective, excluding women from productive workforce results in a significant loss of potential output. Recognising this, international organisations such as the IMF and World Bank emphasise that increasing female labour force participation is not merely a social objective but a critical economic strategy.

Against this backdrop, the present study examines whether higher FLFPR contributes to economic growth across Indian states. By focusing specifically on female labour force participation rather than aggregate labour measures, the study aims to uncover the gender-specific growth effects that remain unaddressed in macro-level analyses. This paper thus contributes to the existing literature by providing state-level empirical evidence on the female labour–growth nexus in India, with important implications for region-specific and gender-inclusive policy formulation.

Review of Related Studies

Appiah (2018) [1], examined the relationship between female labour force participation and its impact on economic growth. The paper further explores whether the impact of the female labour force participation on economic growth is different for developing countries as a whole compared with countries in sub-Saharan Africa (SSA). The study uses panel data of 139 countries and concludes that female labour force participation has positive marginal impact on per capita GDP growth rate.

Lechman, E., & Kaur, H. (2015) [19], studied the relationship between female labour force and economic growth in 162 world countries over the period 1990-2012. The study finds strong support for a U-shaped relationship in static models, particularly for high-income and upper-middle-income countries, while the evidence weakens or reverses for lower-middle- and low-income economies.

Mujahid, N., & uz Zafar, N. (2012) [22]. empirically examined the nexus between female labour force participation (FLFP) and economic growth in Pakistan over the period 1980–2010. Using time-series data and employing the ARDL bounds testing approach along with ECM and VECM Granger causality techniques, the study finds a robust long-run cointegrating relationship between real GDP per capita and female labour force participation.

Fatima, A., & Sultana, H. (2009) [12] examined the U-shaped relationship between female labour force participation (FLFP) and economic development in Pakistan using pooled provincial and regional data for 1992–93, 1996–97, and 2001–02, and finds strong empirical support for the hypothesis.

Lahoti and Swaminathan (2016) [18] provided a rigorous and policy-relevant analysis of the puzzling coexistence of rapid economic growth and declining female labour force participation (FLFP) in India using state-level panel data from 1983–84 to 2011–12 .Challenging the widely accepted U-shaped hypothesis between economic development and women's labour supply, the authors show that no robust U-shaped relationship exists at the state level once endogeneity, education, and regional and time fixed effects are controlled for through dynamic panel (GMM) methods.

Dhar and Sarkar (2024) [10] examined the relationship between FLPR and real GDP in Bangladesh for the period 1995-2021. The study revealed that female labour force participation rate has significant positive impact on real GDP.

Kuldasheva, Z., & Ahmad, M. (2025) [17] made a policy-relevant empirical examination of the growth effects of female labour force participation at both aggregate and sectoral levels across Central Asian economies during 1995–2022. Using robust panel techniques, including fixed and random effects and system GMM to address endogeneity and reverse causality, the study finds found that a 1 % increase in female labour force participation is associated with approximately a 0.51 % increase in economic growth**,** indicating a positive and statistically significant link between participation and GDP growth**.**

Rationale of the Present Study

After reviewing the empirical evidence on the relationship between female labour force participation (FLFP) and economic growth from various parts of the world, the present study focuses on India, where the nexus appears particularly complex and policy-relevant. While cross-country and country-specific studies largely indicate a positive or U-shaped relationship between FLFP and economic growth (Appiah, 2018; Lechman & Kaur, 2015; Mujahid & uz Zafar, 2012; Fatima, A., & Sultana, H., 2009) [1, 12, 19, 22], evidence from India remains inconclusive and even contradictory as some of the studies claimed to have find no relationship between female employment and economic growth, while some other studies documented positive or U-shaped relationship. Despite sustained economic growth, India has witnessed persistently low and declining female labour force participation, raising questions about the applicability of the conventional development hypothesis in the Indian context (Lahoti & Swaminathan, 2016) [18]. Given India's vast inter-state differences in economic structure, educational attainment, and labour market conditions, a state-level panel data analysis provides a more appropriate framework to examine the effects of FLFP on economic growth. By employing panel econometric techniques, this study seeks to reassess the relationship between female labour force participation and economic growth across Indian states, thereby contributing to the literature by offering context-specific insights and policy-relevant evidence.

Objectives of the Present Study

1. To analyse the national trend and the extent of inter-state and inter-regional disparities in female labour force participation in India.
2. To analyse the impact of FLFPR on economic growth (GSDP) across Indian states.

Data and Methodology

Data: The Study is based on secondary data mainly collected from the following sources-

- **Periodic Labour Force Survey (PLFS, 2017-18 to 2022-23) –** Female Labour Force Participation Rate.
- **National Family Health Survey (NFHS-5)-** Total Fertility Rate.
- **MoSPI**- State-wise Growth Rate of Net State Domestic Product.
- **Census of India, 2011 –** Female literacy rate and Urbanisation.

Period of the Study: The study covers the period 2017–18 to 2022–23. The study period from 2017–18 to 2022–23 is deliberately chosen because the Periodic Labour Force Survey (PLFS) provides consistent year-wise data on female labour force participation from 2017–18 onwards only. The terminal year 2022–23 is chosen as it is the latest year up to which all the required data for the study is available.

Empirical Analysis and Results

Table-1.1 represents the descriptive statistics of the key variables used in the study. During the study period (2017-

18 to 2022-23) the average real NSDP growth rate of the selected Indian states is 5.65 per-cent with considerable variation, as indicated by a standard deviation of 4.70 per-cent. The female labour force participation is the key independent variable of the study. The average female labour participation for the selected years and state is 33.54, which is quite low in comparison to the developed economies of the world

Table 1: Descriptive Statistics of Key Variables Used in the Study

Variables	Mean	Standard Deviation	Maximum	Minimum
Real NSDP Growth Rate (%)	5.65	4.70	14.55	-9.43
FLFPR (%)	33.54	14.00	71.40	4.1
FLR (%)	69.14	10.50	92.07	51.50
URBN (%)	30.75	12.63	62.17	10.04
TFR (%)	2.25	0.63	3.74	1.40

Source: Computed by the author based on Secondary data

Moreover, there exists noticeable inter-state variation in FLFPR across the selected states, as highest FLFPR is 71.40 per-cent and lowest FLFPR is 4.1 per-cent. The mean female literacy rate (FLR) for the selected state is 69.14 and standard deviation is 10.50 per-cent. Urbanisation (URBN) as measured by percentage of urban population shows that on an average only 30.75 per-cent of the population resides in urban areas. Finally, the mean total fertility rate (TFR) for the selected states is 2.25 and standard deviation value is 0.63

National trend and the extent of inter-state and inter-regional disparities in female labour force participation in India., 2017-18 to 2022-23

The first objective of this study is to examine the trend and inter-state variation in female labour force participation in India. To fulfil this objective the study basically relies on graphical representation of Periodic Labour Force Survey (PLFS) data of female labour force participation. Chart 1.1, presents the trend of female labour force participation rate during the study period 2017-18 to 2022-23. In 2017-18, the FLFPR is less than 25 per-cent, which has gradually increased to over 40 per-cent by 2022-23. From the chart it is clearly visible that after 2020-21, there is a sharp increase in FLFPR, which may be attributed to the fact that covid-19 pandemic has increased household expenses and push women to enter the labour market. State -wise average female labour force participation is presented in chart-1.2. During the study period 2017-18 to 2022-23 Himachal Pradesh has the highest FLFPR (71.40 percent) and Bihar records the lowest FLFPR (4.1 per-cent). Thus, there exists considerable inter-state variation in FLFPR across the selected Indian states. Further, to depict the temporal trend and inter-state variation in FLFPR, box plot and mean trend line is presented in chart-1.3. The red line shows the mean FLFPR across the states. The mean FLFPR shows a clear upward trend, increasing from around less than 25% in 2017–18 to over 40% in 2022–23. The box plots show the distribution of FLFPR across states for each year. The wide boxes and long whiskers indicate substantial differences in FLFPR among the selected states for each year. Even in the same year, FLFPR ranges from very low levels (around 10–15%) in some states to very high levels (above 60%) in others. Moreover, the presence of outliers above the median line (line inside the box) exhibits that certain states are performing exceptionally well in female employment generation.

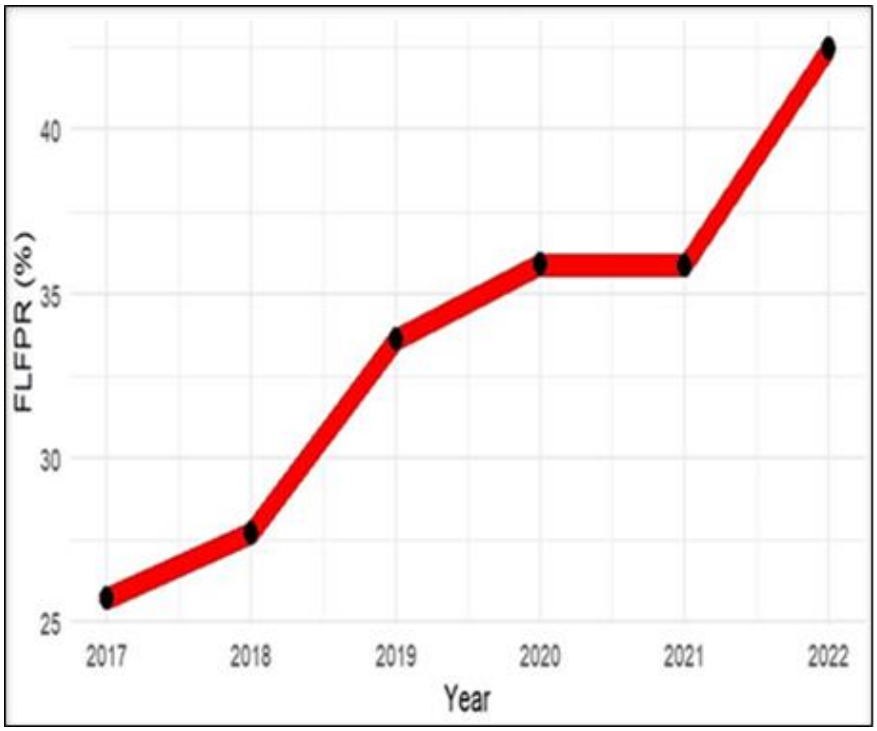


Chart 1: Trend of Female Labour Force Participation in India (2017-18 to 2022-23)

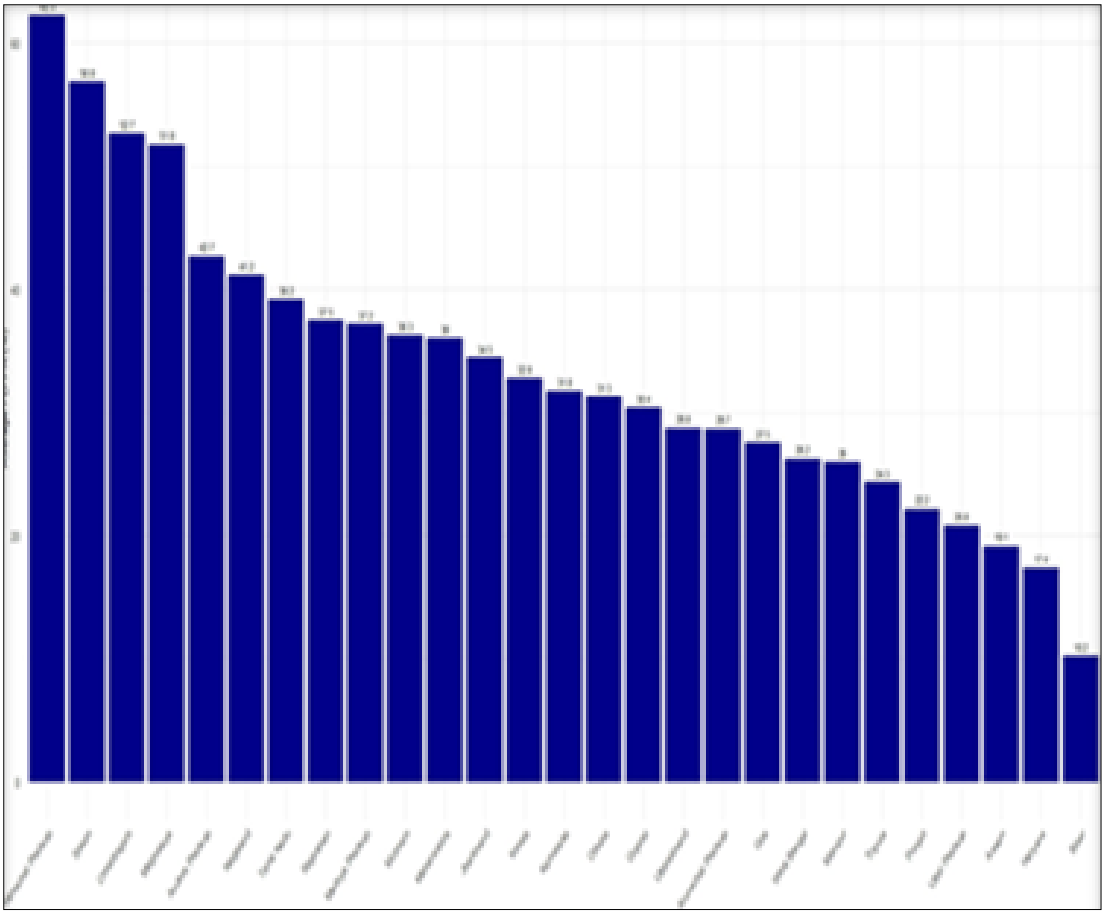


Chart 2: Average Female Labour Participation by State (2017-18 to 2022-23)

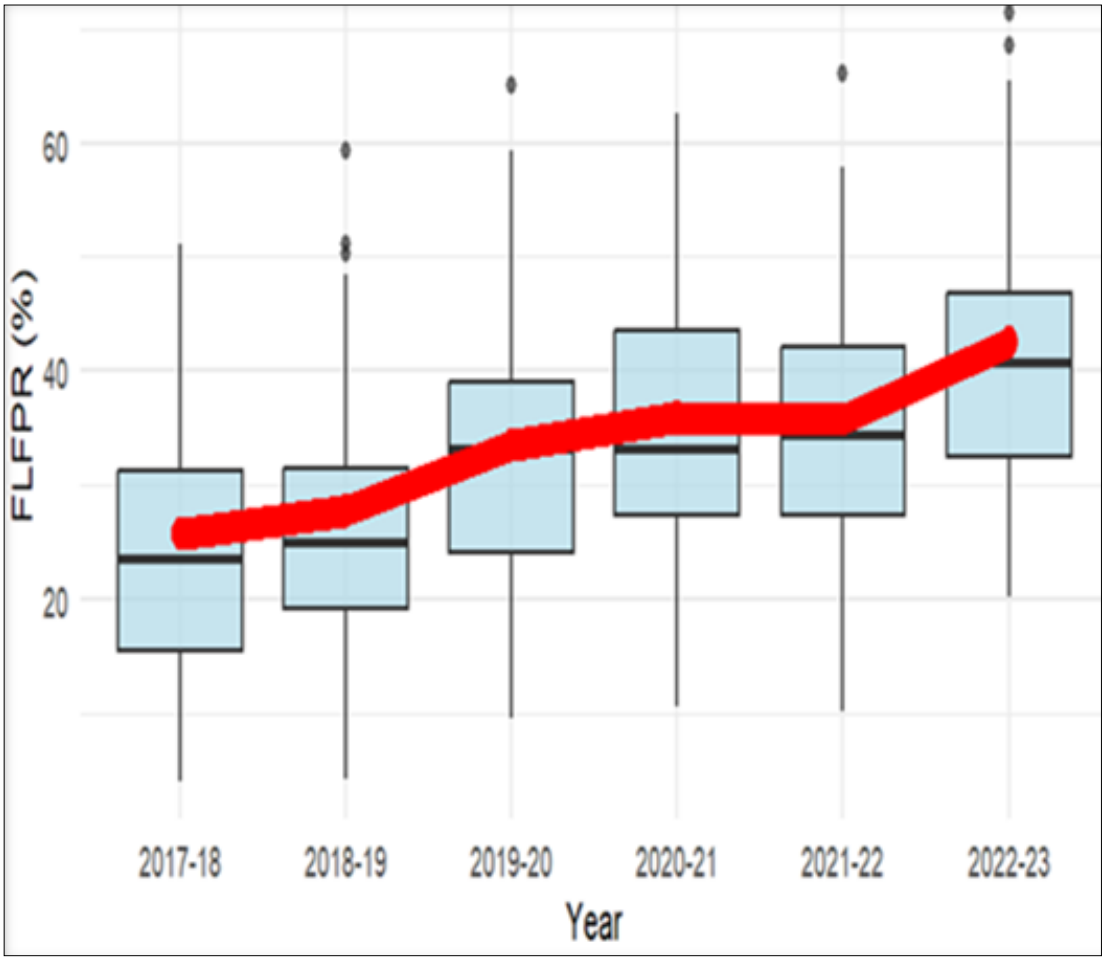
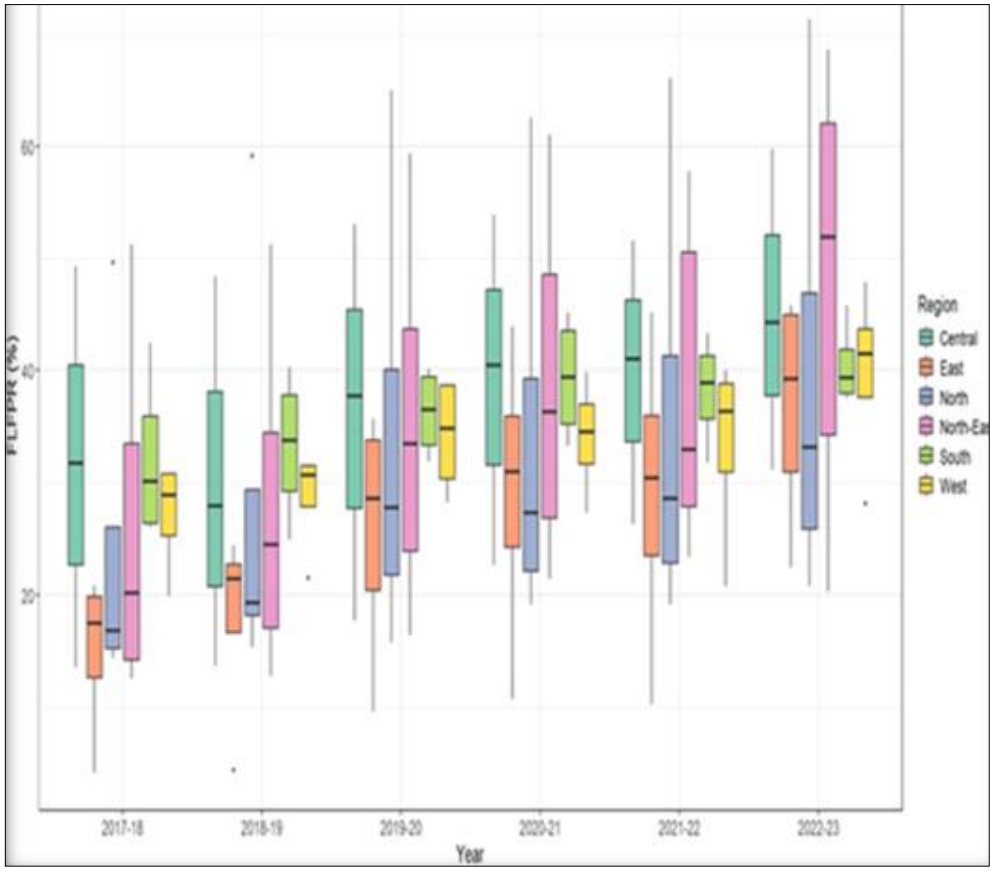


Chart 3: Trend and Inter-state Variation in FLFPR, (2017-18 to 2022-23)



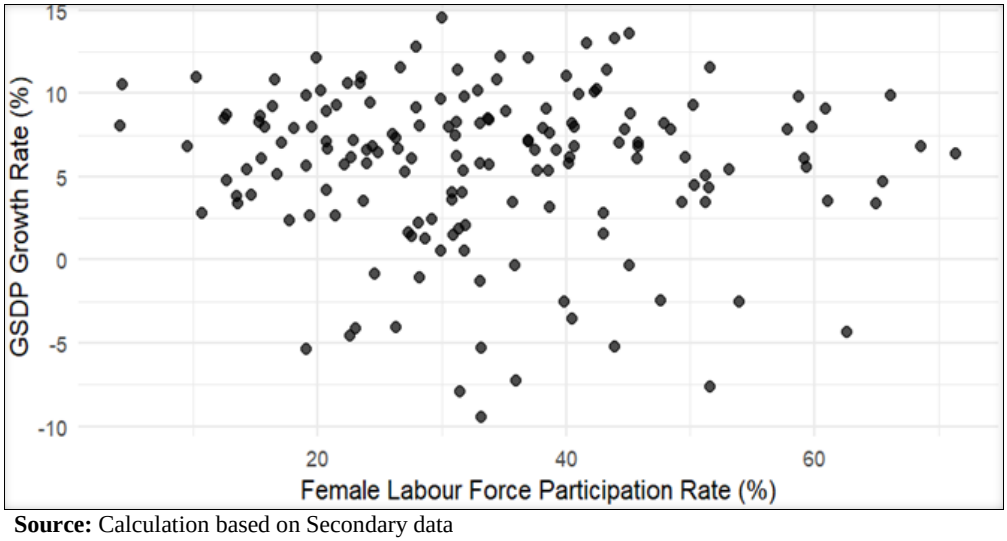
Source: Self calculation based on PLFS, (2017-18 to 2022-23)

Chart 4: Inter-Regional Variation in FLFPR (2017-18 to 2022-23)

Chart-1.4 depicts inter regional variation in FLFPR through median FLFPR. Median FLFPR represents the middle value of female labour force participation across states within a region for a given year. The straight line inside the box represents median FLFPR. In the year 2017-18, FLFPR is uniformly low for all the regions, with a median FLFPR value of less than 35 per-cent for all the region. In this year southern region exhibits the highest FLFPR, followed by the west and central region, whereas, the Northern and Eastern region records the lowest FLFPR. The North-East shows wide dispersion, reflecting strong inter-state heterogeneity within the region. Similar pattern of inter-regional variation is observed till 2021-22. However, in 2022-23, the North - Eastern region turns out to be the best performer in terms of female labour force participation, while Southern region continues to maintain its high participation level. The Central and the Westen region exhibit steady but moderate performance, whereas the Eastern and Northern regions continue to lag behind during the entire study period.

Nexus between Economic Growth and Female Labour Force Participation Rate

To assess the relationship between economic growth and female labour force participation across the sample states, a scatter plot is presented



Source: Calculation based on Secondary data

Chart 5: Relationship between Economic Growth and FLFPR

The above scatter plot indicates a non-linear type of relationship between economic growth and female labour force participation and hence, Karl Pearson's coefficient of correlation is not a proper technique to assess the degree and direction of relationship between the two variables.

Various studies have reported to find 'U' shaped relationship between economic growth and FLFPR growth (Appiah, 2018; Lechman & Kaur, 2015; Mujahid & uz Zafar, 2012) [1, 19, 22]. Accordingly, in this study, we will test the empirical validity of this U type relationship in Indian context.

Model Specification

To investigate the relationship between female labour force participation and economic growth across the selected Indian states, a panel data model is estimated for the period 2017-18 to 2022-23. Three alternative estimators—Pooled Ordinary Least Squares (POLS), Fixed effects (FE), and Random effects (RE)—are considered to account for unobserved heterogeneity across states and over time. However, in estimating the impact of female labour force participation on economic growth, a potential concern is the problem of endogeneity arising out of reverse causality as economic growth and FLFPR both reinforce each other. To overcome this problem, instead of the current values, lagged values of the FLFPR is used in the study. This will ensure that current economic growth does not influence past labour force participation. Further, the use of lagged values of FLFPR is also justified on the ground of economic theory. The Female labour force participation can not influence growth instantaneously. The productivity gains from increased participation involves indirect mechanism like acquired skill and specialisation leading to increase productivity and higher wage, mobility to better jobs etc and all of these requires a gestation period. At the same time, lagged values of FLFPPR represents stock of female labour experience already embedded in production. Accordingly, the model is specified as under-

$$Real\ NSDP\ Growth_{it} = \alpha + \beta_1 FLFPR_{i,t-1} + \beta_2 FLFPR_{i,t-1}^{\ 2} + \beta_3 FLR_{it} + \beta_4 URBN_{it} + \beta_5 TFR_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad \textbf{(1)}$$

Depending upon the estimated values of significant β coefficients, the relationship between economic growth and FLFPR can be identified as follows

$$'U'\ Shaped \longrightarrow \beta_1<0\ and\ \beta_2>0,\ Inverted\ 'U' \longrightarrow \beta_1>0\ and\ \beta_2<0,\ Positive\ and\ Convex$$

$$\longrightarrow \beta_1>0\ and\ \beta_2>0,\ Negative\ and\ Concave \longrightarrow \beta_1<0\ and\ \beta_2<0$$

Model Selection and Interpretation of the Coefficients

First, the pooled OLS model is estimated, which is based on the assumption of homogeneity across states and ignores state-specific effects. The F-statistic being insignificant for this model makes the pooled OLS estimator inappropriate. Accordingly, both fixed effects and random effects model are estimated and Hausman test is applied to select the appropriate one. The Hausman test being significant, indicates the presence of unobserved state specific effects and hence, fixed model is the most appropriate specification for this particular analysis. Further, the appropriateness of fixed effect model is also confirmed by significant value of F-statistic. The fixed effect model captures within-state variation over time, controlling for unobserved state-specific factors. The estimated coefficients of the fixed-effects regression model indicate that out of all the independent variable Total Fertility Rate (TFR) is the only significant determinant of economic growth.

Table 2: Description and Justification of the Variables

Variables	Description & Justification	Expected Effect
Real Net State Domestic Product Growth **(**NSDP Growth)	To measure the economic growth of Indian States year-wise Real Net State Domestic Product Growth rates is used as the dependent variable	--
Female Labour Force Participation Rate (FLFPR)	Female Labour Force Participation Rate is the key explanatory variable in the study. An increase in female labour force participation expands the effective labour supply, improves resource utilisation, and enhances overall productivity	Positive
Female Literacy Rate (FLR)	Female literacy rate is included as a proxy for human capital development among women Higher female literacy enhances labour productivity and supports economic growth.	Positive
Urbanisation (URBN)	Urbanisation is measured in terms of percentage of urban population and incorporated to capture the structural transformation of the economy. Urban areas typically provide better access to education, infrastructure, formal employment, and flexible work arrangements. Consequently, higher urbanisation is expected to positively influence economic growth.	Positive
Total Fertility Rate (TFR)	Total Fertility Rate is included to account for demographic and household-level constraints on female labour supply. Higher fertility increases women's unpaid care responsibilities and reduces their availability for market work. As a result, higher fertility is expected to negatively affect economic growth	Negative
μ_i	State fixed effects	
λt	Time Fixed Effect	

Table 3: Estimated Regression Result of Static Panel Model Pooled OLS, FE and RE

Dependent Variable: Real NSDP Growth Rate			
Independent Variable	**Pooled OLS**	**Fixed Effect**	**Random Effect**
	Coefficients (Standard Error)	**Coefficients (Standard Error)**	**Coefficients (Standard Error)**
FLFPR	-0.107 (0.131)	0.027 (0.158)	-0.134 (0.1402)

$FLFPR^2$	0.001 (0.001)	0.0004 (0.0057)	0.001 (0.0019)
FLR	0.021 (0.047)	--	0.021 (0.060)
URBN	-0.004 (0.044)	--	0.060 (0.055)
TFR	0.629 (0.640)	42.41* (7.070)	0.8376** (0.041)
Intercept	4.4041758 (4.4833527)	--	4.60
R- Square	0.016	0.22	0.14
F-Statistic	0.516	12.59*	2.58

Source: Calculation based on Secondary Data

This implies that that changes in fertility over time within states affect growth. The estimated value of the coefficient shows that a one-unit change in TFR is associated with a 42.4 percentage point change in GSDP growth**.** The fixed effects model is unable to estimate the coefficients of Female Literacy Rate (FLR) and Urbanisation (URBN) because these variables are time-invariant over the study period. Specifically, FLR and URBN are measured using Census 2011 values and remain constant across all years for each state. As a result, there is no within-state variation in these variables, and their effects are absorbed by the state fixed effects.

However, the key independent variable of the study, the female labour force participation does not have a statistically significant impact on economic growth of the selected Indian states during the study period. Although, both the linear and quadratic terms of female labour force participation are positive but are statistically insignificant, providing no evidence for a 'U-shaped' relationship between economic growth and female labour force participation. Thus, the finding of this study is in conformity with those of Lahoti & Swaminathan, (2017), Romanus and Nkechi, (2024) [23], Baerlochar *et al*., (2021). The possible reason for this insignificant relationship may be attributed to several factors. First, relatively shorter time span of the study may have failed to capture the long run growth benefits of female work force participation. Further, a substantial portion of Indian women are engaged in low paid, informal and low productive sectors and hence, their employment is not translated into growth benefits. However, in order to identify the exact reason, a separate study on sectoral decomposition of women employment pattern is needed. Thus, this study opens a new avenue for future research. In this context, the Nobel winning findings of Claudia Goldin in 2023 is worth mentioning. Goldin's historical analysis shows that despite long-run economic growth, women's labour force participation did not follow a consistent upward trajectory, revealing "no historically consistent association between women's participation in the labour market and economic growth" over two centuries (Goldin, 2023)

Dynamic Panel Estimation: Arellano–Bond Difference GMM

Out of the three different models, Fixed effects model has been found to be statistically significant, yet the estimated coefficients of FLFPR remained statistically insignificant. This implies that the impact of female labour force participation on economic growth may not be realized through immediate or short-run within-state changes. Further, the static panel framework even after taking lagged values of the female labour force participation may have failed to address the problem of endogeneity completely. Therefore, we approach to the dynamic panel framework. In the dynamic panel framework lagged values of the dependent variable is incorporated as one of the regressors in the model. Moreover, the inclusion of lagged values of the dependent variable is also justified on the ground that current economic growth of an economy is significantly influenced by its past growth rates. However, inclusion of a lagged dependent variable may lead to biased and inconsistent estimates due to endogeneity arising from correlation between the lagged dependent variable and the error term. Consequently, estimators may be inadequate to fully capture the dynamic relationship between female labour force participation and economic growth. Thus, the study applies Arellano–Bond (1991) [2] difference GMM approach to account for growth persistence and endogeneity. Arellano and Bond (1991) developed a dynamic panel data model by utilising the orthogonality conditions that exist between lagged values of the disturbance term Y_{it} and the disturbances ε_{it}. Arellano and Bond (1991) derived GMM estimator for the parameters of a dynamic panel data model by taking more instruments available. Arellano and Bond (1991) [2] identify a number of valid instruments in terms of the lag values of the dependent variable, the predetermined variables and the endogenous variables (Das P, 2019.) Accordingly, the dynamic panel model for this study is specified as follows-

$$Real\ NSDP_{it} = \rho\, Real\ NSDP_{i,(t-1)} + \beta_1 FLFPR_{i,(t-1)} + \beta_2 FLFPR^2_{i,(t-1)} + \beta_3 TFR + \mu_i + \varepsilon_{it} \quad \textbf{(2)}$$

In the dynamic panel framework, variables such as female literacy rate (FLR) and urbanisation (URBN) could not be included due to their time invariant nature and since, difference GMM estimator relies within state variation over time and hence, coefficients of these variables are not identifiable through this method.

Equation- 2 shall be estimated by using first difference Generalised Methods of Moments (GMM). The difference GMM is designed to handle a small number of time periods relative to observations, along with issues of autocorrelation, fixed effects, and endogenous independent variables (Arellano and Bond,1991) [2]. In difference GMM, regressors are transformed by differencing or taking forward orthogonal deviations, and lagged levels are used as instruments (Lahoti & Swaminathan, 2017). First difference GMM shall eliminate the State fixed effects (μ_i). Accordingly, after taking first difference, equation-2 can be rewritten as under

$$\Delta Real\ NSDP_{it} = \rho \Delta Real\ NSDP_{i,(t-1)} + \beta_1 \Delta FLFPR_{i,(t-1)} + \beta_2 \Delta FLFPR^2_{i,(t-1)} + \beta_3 \Delta TFR + \Delta \varepsilon_{it} \quad \textbf{(3)}$$

Table 4: Result of Dynamic Panel Estimation: Arellano and Bond Difference GMM estimates

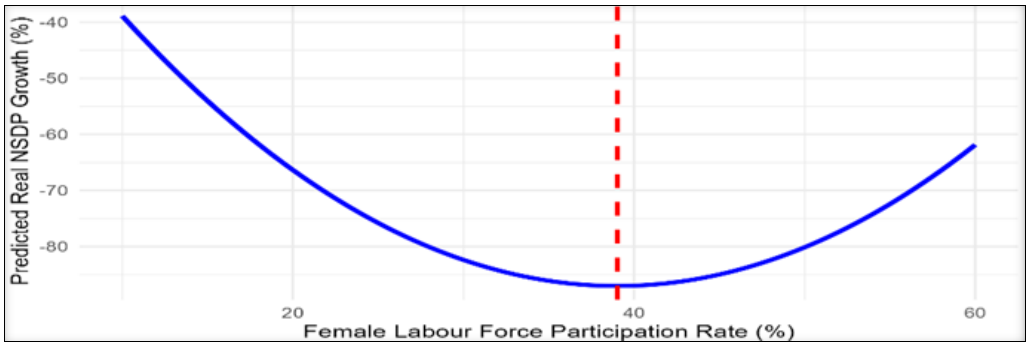
Dependent Variable: *Real NSDP* **Balanced Panel: Number of Cross-Sectional Unit (n) = 27, Time/ Years (T) = 6, Number of Observations (N) = 162**				
Independent Variables	**Coefficients**	**Robust Standard Error**	**Model Diagnostics**	**Values**
			AR (1) P-Value	0.33484
Real NSDP $_{i,,(t-1)}$	-0.892205*	0.000005	AR (2) P-Value	0.85504
FLFPR	-4.460520*	1.417042	Hansen J P-Value	0.27104
$FLFPR^2$	0.057160 *	0.019207	Wald Chi Square	40.018*
TFR	39.56696*	12.82681		

Source: Calculation based on Secondary data
Note: * indicates significance at 1 per-cent of level of significance.

Table-1.4 presents the estimated result of the dynamic panel model. The estimated result shows that all the independent variables incorporated in model are statistically significant. The coefficient of lagged Real $NSDP_{i,(t-1)}$ being negative and statistically significant at 1 per-cent level of significance implies current real NSDP growth of a state is negatively influenced by its past growth. In other words, states with higher growth in the previous period tend to experience slower growth in the current period, and vice versa. This negative relationship indicates the presence of conditional convergence, or mean reversion, across Indian states. Such a pattern is consistent with neoclassical growth theory, which predicts diminishing returns to capital and slower growth as economies approach their steady-state levels of income. Similar evidence of mean reversion in growth dynamics has been reported in earlier studies (Barro, 1991; Cerra & Saxena, 2008) [4, 5]. In the static panel framework, it has been observed that female labour force participation has no statistically significant impact on economic growth but in the dynamic panel framework both the linear and square term of female labour force participation has been found to be statistically significant. This contradiction may be attributed to the fact that static panel model does not account for the growth persistence, delayed adjustment effect and the endogenous nature of labour supply decisions. The estimated coefficient of linear FLFPR (β_1) is negative, while its square term (β_2) is positive, provides the evidence of 'U- shaped' relationship between FLFPR and economic growth. Thus, this particular finding of our dynamic panel framework is closely aligned with those reported by Chapman (2015) [6], Fatima and Sultana (2009) [12], Goldin (1994) [14], Husain (2016) [15], Tansel (2001), and Tsani *et al*. (2013) [26]. This 'U-shaped' relationship indicates that at lower levels of FLFPR, as the participation rate increases, economic growth declines possibly due to women engagement in low paid jobs, low productive sectors, employment in informal sector etc. However, beyond a certain threshold level (turning point) square term dominates indicating that higher and sustained female labour force participation contributes to economic growth possibly due to women's engagement in more productive sectors, increase in wage due to acquired skills etc. Therefore, in this context it is essential to estimate the turning point –

$$Turning\ Point\ of\ FLFPR = -\left(\frac{\beta_1}{2\beta_2}\right)$$

The turning point of female labour force participation rate occurs approximately at 39 per-cent. This indicates that below 39 per-cent increase in FLFPR is associated with lower economic growth and above 39 per-cent further increase in FLFPR positively contributes to economic growth.



Source: Calculation based on Dynamic Panel Model (Eq-3)

Chart 6: Predicted Effect of Female Labour Force Participation on Real NSDP Growth

On the basis of the estimated coefficients of FLFPR (linear and square term), the U-shaped relationship between FLFPR and economic growth is plotted in chart-1.6. Finally, as in the case of static panel framework, the coefficient of Total Fertility Rate (TFR) is statistically significant in the dynamic panel framework also.

Model Validation

The dynamic panel model is validated through certain model diagnostic checks like AR (1) and AR (2) for serial correlation, Hansen test for testing instrument validity and Wald Chi square for explanatory power of the model. The p-value of AR (1) test being insignificant, indicates the presence of first order serial auto correlation in first differenced errors. However, the insignificant AR (1) test does not violate any identifying condition and credibility of the model. In our study, the insignificant AR (1) test may be because of small size of the panel. For proper model validation, AR (2) test must be insignificant as insignificant AR (2) test validates the use of lagged levels as instruments in the Difference GMM estimation. In the Arellano–Bond Difference GMM framework**,** the AR (2) test confirms instrument validity by checking for second-order

autocorrelation in the first-differenced residual E ($\Delta\epsilon_{it}$, $\Delta\epsilon_{i,(t-2)}$) =0. The estimated P-value of the AR (2) test being insignificant implies that there is no second order auto correlation between the error terms. While the insignificant AR (2) test confirms that error structure of the model does not make the instruments invalid, the Hansen J test examines whether the chosen instruments are actually valid or all instruments are jointly exogeneous. The estimated p-value (0.27104) for Hansen test being insignificant indicates that all instruments of the model are valid and jointly exogeneous. Finally, the overall explanatory power of the model is checked through Wald Chi Square. The Wald chi-square value being significant at 1 per-cent level indicates that our dynamic panel model has strong explanatory power.

Conclusion

This study is an attempt to reassess the relationship between female labour force participation and economic growth using a panel data framework of selected Indian states over the period 2017-18 to 2022-23.

The trend of female labour force participation at national level shows that there has been a gradual increase in FLFPR since 2017-18 and mainly after covid-19 pandemic there has been a sharp increase in FLFPR. State -wise Himachal Pradesh records the highest average FLFPR at 71.40 per-cent and Bihar witnessed the lowest FLFPR at 4.1 per-cent during the period 2017-18 to 2022-23, showing wide variation across the states. Inter-regional variation in FLFPR is also evident from the study, while the Southern and North Eastern region are among the top performer, Eastern and Northern regions are lagging behind.

To identify the impact of FLFPR on economic growth, the study adopts a sequence of econometric technique. First, the study proceeds with static panel framework and three different estimation techniques -Pooled OLS, Fixed Effect and Random Effect are used. Model selection criteria identified Fixed Effects estimation as more appropriate than Pooled OLS and Random Effects. The results from the static fixed effects model revealed that FLFPR does not have any statistically significant impact on economic growth in the short run and thereby, rejects the empirical validity of U-shaped hypothesis. Consequently, the study remodelled the relationship in term of dynamic panel framework and Arellano–Bond difference GMM estimation method is applied. The dynamic panel model identifies both the linear and quadratic terms of female labour force participation are statistically significant, revealing a non-linear, U-shaped relationship between female labour force participation and real NSDP growth. This finding indicates that at lower levels of female labour force participation, increases in women's employment may not immediately translate into growth benefits, possibly due to concentration in low-productivity or informal sectors. Beyond a critical threshold, however, higher female participation contributes positively to economic growth, reflecting improved labour market integration and productivity gains. The estimated value of the critical threshold is 39 per-cent approximately, indicating that below 39 per-cent increase in FLFPR is associated with lower economic growth and above 39 per-cent further increase in FLFPR positively contributes to economic growth.

Total fertility rate emerges as a robust and significant determinant of economic growth in static as well as dynamic panel framework. The reliability of our dynamic panel model is checked through certain model diagnostic tests and result shows no evidence of second-order serial correlation and acceptable instrument validity.

Overall, the findings suggest that the growth effects of female labour force participation are neither instantaneous nor linear, and that policy efforts targeting only to increase participation rates may not be sufficient unless accompanied by improvements in job quality, transformation from informal to formal sector, imparting required training and skills.

References

1. Appiah EN. Female labor force participation and economic growth in developing countries. Global Journal of Human-Social Science: E Economics,2018:18(2):175-92.
2. Arellano M, Bond S. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. The review of economic studies,1991:58(2):277-297.
3. Baerlocher D, Parente SL, Rios-Neto E. Female labor force participation and economic growth: Accounting for the gender bonus. Economics Letters,2021:200:109740.
4. Barro RJ. Economic growth in a cross section of countries. The quarterly journal of economics,1991:106(2):407-443.
5. Cerra V, Saxena SC. Growth dynamics: the myth of economic recovery. American Economic Review,2008:98(1):439-457.
6. Chapman KA. Economic development and female labor force participation in the Middle East and North Africa: A test of the U-shape hypothesis. Gettysburg Economic Review,2015:8(1):3.
7. Chaudhary R, Verick S. Female labour force participation in India and beyond. ILO Working Papers, 2014, (994867893402676).
8. Cuberes, Teignier. "`Does gender inequality hinder growth? The evidence and its policy implications', Background paper for the World Bank World Development Report 2012: Gender equality and development", 2011.
9. Das P, editor. Econometrics in theory and practice. Physica-Verlag Heidelberg, 1998.
10. Dhar S, Sarker T. An ARDL Method for Evaluating Bangladesh's Economic Growth Concerning Female Secondary Education. Vision, 2024, 09722629241253750.
11. Esteve-Volart B. Gender discrimination and growth: Theory and evidence from India. LSE STICERD research paper no. DEDPS42, 2004.
12. Fatima A, Sultana H. Tracing out the U-shape relationship between female labor force participation rate and economic development for Pakistan. International Journal of Social Economics,2009:36(1/2):182-198.
13. General R. Census Commissioner, India. Census of India, 2000, 2011.
14. Goldin C. The U-shaped female labor force function in economic development and economic history, 1994.
15. Husain H. Economic development, women empowerment and U shaped labour force function: Time series evidence for Bangladesh. Asian Economic and Financial Review,2016:6(12):719.

16. Klasen S, Pieters J. What explains the stagnation of female labor force participation in urban India? The World Bank Economic Review,2015:29(3):449-478.
17. Kuldasheva Z, Ahmad M. Empowering economic growth through female labor force participation in central Asia: Evidence from regression and dynamic analyses. Asia and the Global Economy,2025:5(2):100115.
18. Lahoti R, Swaminathan H. Economic development and women's labor force participation in India. Feminist Economics,2016:22(2):168-195.
19. Lechman E, Kaur H. ECONOMIC GROWTH AND FEMALE LABOR FORCE PARTICIPATION–VERIFYING THE U-FEMINIZATION HYPOTHESIS. NEW EVIDENCE FOR 162 COUNTRIES OVER THE PERIOD 1990-2012. Economics & Sociology,2015:8:246-257.
20. Ministry of Health and Family Welfare. National Family Health Survey-5. Government of India, 2019-21.
21. Ministry of Statistics and Programme Implementation (MoSPI). Periodic Labour Force Survey (PLFS). Government of India, 2017–18 to 2022–23.
22. Mujahid N, uz Zafar N. Economic growth-female labour force participation nexus: An empirical evidence for Pakistan. The Pakistan Development Review, 2012, 565-585.
23. Romanus U, Nkechi C. Nexus between Labour Force Participation, Decent Work and Economic Growth in Nigeria. International Journal of Research and Scientific Innovation, 2024, XI(2321).
24. Shahid M. Impact of labour force participation on economic growth in Pakistan. Journal of Economics and Sustainable Development,2014:5(11):89-93.
25. Tansel A. Economic development and female labor force participation in Turkey: Time-series evidence and cross-section estimates. METU/ERC Working Paper, 2002, (02/3).
26. Tsani S, Paroussos L, Fragiadakis C, Charalambidis I, Capros P. Female labour force participation and economic growth in the South Mediterranean countries. Economics Letters,2013:120(2):323-328.
27. Yakubu MM, Akanegbu BN, Jelilov G. Labour force participation and economic growth in Nigeria. Advances in Management and Applied Economics,2020:10(1):1-14.