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Resolving the Dilemma of Unemployment Rate Hysteresis Versus the Natural Rate Hypothesis in India

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Abstract

This study investigates the presence and degree of hysteresis in India's unemployment rates, with particular attention to gender disparities across pre- and post-COVID-19 periods. Using quarterly data from Q2 2018 to Q2 2025, the analysis employs standard unit root tests, unit root tests with structural breaks, and Variance Ratio (VR) analysis to evaluate whether unemployment follows a persistent random walk—indicative of strong hysteresis—or exhibits mean-reverting behavior consistent with the natural rate hypothesis. Results from conventional unit root tests support the natural rate hypothesis, while structural break tests suggest the presence of non-stationarity, indicating a mild form of hysteresis. The VR analysis reinforces this mixed conclusion, revealing moderate mean reversion alongside limited shock persistence. Overall, the findings suggest that the natural rate hypothesis holds predominantly in India, although asymmetric labor market adjustments—especially during major disruptions such as the COVID-19 pandemic—indicate that mild hysteresis effects persist. These results imply that structural labor market reforms and targeted upskilling policies are more effective than prolonged cyclical interventions in ensuring long-run employment stability.

Keywords: unemployment hysteresis; unit root tests; structural breaks; natural rate of unemployment; India
JEL Codes: C22; E24; J16; B23

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1. Introduction

In labor markets, unemployment hysteresis is a critical phenomenon that warrants thorough examination when formulating government policies to mitigate the effects of unexpected economic shocks. In certain economies, following a temporary shock, the unemployment rate does not return to its natural level. This persistence poses a potential threat, as it reflects an inherently self-sustaining characteristic. According to Graafland (1988), the concept of hysteresis implies that current outcomes are dependent on past conditions or historical trends. In essence, temporary shocks in the past can exert a lasting influence on the present equilibrium.

Blanchard and Summers (1986) were among the most notable contributors to the unemployment hysteresis literature. They proposed that the natural unemployment rate is influenced by past fluctuations or shocks in the actual unemployment rate. This view challenges Friedman's traditional natural rate hypothesis, which asserts that temporary deviations from the natural rate do not have long-term effects. Conventionally, unemployment has been regarded as stationary, meaning that it remains unaffected by demand- or supply-side disturbances. However, the natural rate hypothesis has difficulty explaining phenomena such as stagflation. In contrast, the hysteresis hypothesis offers a compelling framework to address labor market rigidities, particularly the persistent effects of unemployment-related shocks (Ball & Onken, 2021).

Several theoretical approaches provide support for the existence of unemployment hysteresis, including the insider-outsider model, the human capital approach, and the physical capital approach. First, the insider-outsider model proposed by Lindbeck and Snower suggests that employed workers (insiders), due to their bargaining power, inhibit the entry of unemployed job seekers (outsiders) by erecting barriers such as higher wage expectations, specific skill requirements, and established social networks. These factors can prolong unemployment spells.

Second, the human capital approach emphasizes the role of skills and productivity. Workers who experience prolonged unemployment may suffer skill depreciation, making re-employment more difficult even after the economy recovers. As a result, while the business cycle may normalize, the unemployment rate does not necessarily revert to its pre-shock level.

Third, the physical capital approach suggests that sustained high unemployment can reduce firms' investments in physical capital such as infrastructure, technology, and equipment. This decline in investment suppresses aggregate demand, reduces job creation, and leaves the labor force less equipped for re-entry into the job market, resulting in a low-level equilibrium trap.

The contrasting dynamics of the natural rate hypothesis and unemployment hysteresis can be expressed using the following equation:

$$u_t^* = u_{t-1}^* + \rho\,(u_{t-1} - u_{t-1}^*) \qquad (1)$$

where u^*_t is the natural unemployment rate in period t, u^*_{t-1} is the natural rate in the previous period,

u_{t-1} is the actual unemployment rate in the previous period, and ρ captures the degree of hysteresis.

- If ρ=0, the natural unemployment rate remains constant, indicating no hysteresis and full support for the natural rate hypothesis (see Figure 1).
- If 0<ρ<1, the natural rate partially adjusts toward the actual rate, indicating weak or partial hysteresis.
- If ρ=1, the natural rate fully adjusts to the actual unemployment rate, signifying strong hysteresis.

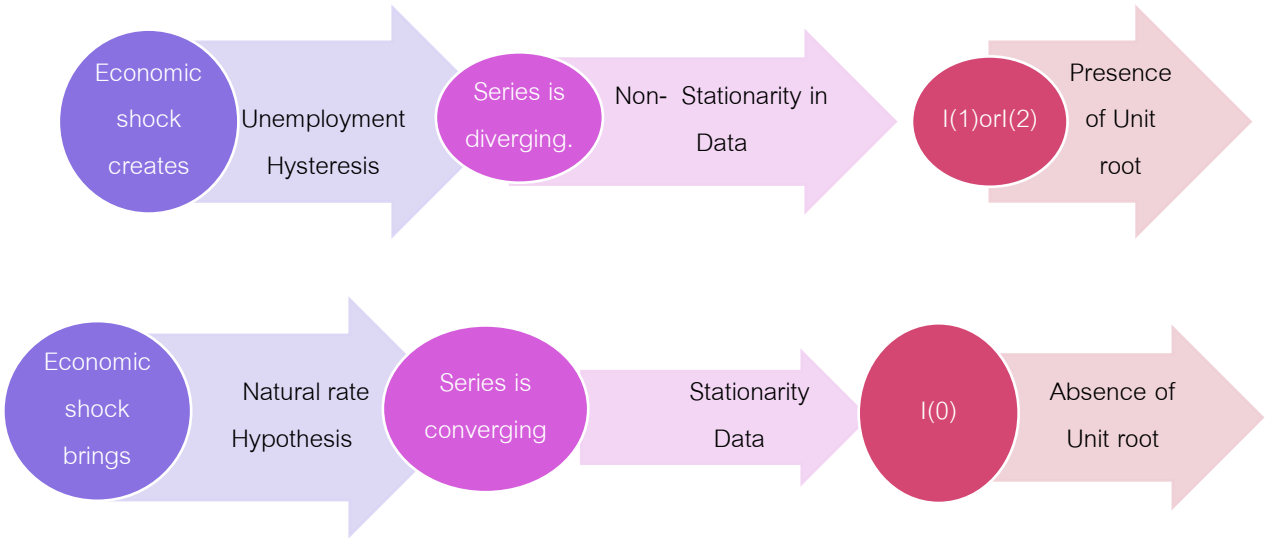


Figure 1: Representation of Unemployment Hypotheses Based on Unit Root Tests

Source: Author's compilation

In empirical macroeconomics, a wide array of unit root tests has been employed globally (Cerra et al., 2020) to assess the nature of unemployment. If the unemployment series is found to be stationary, the natural rate hypothesis holds. Conversely, non-stationarity implies persistent deviations due to shocks—supporting the unemployment hysteresis hypothesis. If macroeconomic shocks exert lasting effects on unemployment, it presents a complex policy dilemma requiring careful attention.

While several alternative mechanisms exist in the literature to test for hysteresis in labor markets, this study aims to identify the nature of unemployment fluctuations in the Indian context using time-series data. The central question is whether India's labor market dynamics support the natural rate hypothesis or exhibit features of unemployment hysteresis.

Accordingly, the following hypotheses are proposed:

- **Null Hypothesis (H_0)**: The unemployment rate series (overall, male, and female) in India is stationary, implying support for the natural rate hypothesis. Economic shocks have only temporary effects.
- **Alternative Hypothesis (H_1)**: The unemployment rate series is non-stationary, indicating the presence of hysteresis. Economic shocks have persistent or permanent effects.

The remainder of this paper is organized as follows: Section 2 presents a review of the literature with a focus on time-series modeling; Section 3 outlines the data and econometric methodology; Section 4 provides the empirical results; and Section 5 concludes with a discussion of limitations and policy implications.

2. Literature Review

Since the pioneering work of Blanchard and Summers (1986), the unemployment hysteresis hypothesis has received substantial attention in empirical economic research. Many studies have focused on groups of countries and have employed diverse econometric methodologies to examine the validity of this hypothesis across different regions and time periods. Table 1 summarizes key studies relevant to unemployment hysteresis.

Table 1: Summary of Selected Empirical Studies on Unemployment Hysteresis

Authors (Year)	Countries	Data Period	Methodology	Key Findings
Alpagut (2024)	Türkiye and the EU	2001Q1–2019Q4	FF-ADF and FFFF-ADF tests	No evidence of hysteresis in Türkiye and the EU.
Akay et al. (2020)	13 transition countries	2000–2017	Linear and nonlinear unit root tests with structural breaks	Hysteresis valid in most countries except Kazakhstan and Slovak Republic.
Bakas et al. (2014)	Greece	1998Q1–2011Q2	Panel unit root tests with structural breaks and cross-sectional dependence	Strong support for hysteresis in Greek regions.
Meng et al. (2017)	14 OECD countries	1983Q1–2013Q3	Unit root tests with structural breaks, nonlinear Fourier test	Hysteresis valid in 4 out of 14 countries.
Özpence and Ergen (2017)	Türkiye	2000–2013 (quarterly)	Traditional unit root and Lee-Strazicich tests	Evidence supports hysteresis.
Canarella et al. (2019)	USA and 20 MSAs	1990–2016	Kejriwal, Perron, and Zhou tests	Mixed support for hysteresis.
Omay et al. (2020)	United States	1976–2017	Unit root tests with structural breaks	Evidence supports hysteresis.
Benati and Lubik (2021)	United States	1960–2020	Cointegrated SVAR	No evidence of hysteresis.
IMF (2020)	Advanced Economies	1980–2019	Literature review	Suggests persistent effects of business cycles on long-term output.
Tiwari (2014)	Australia	1978–2010	Linear and nonlinear unit root tests with structural breaks	Supports the natural rate hypothesis.
Awolaja et al. (2021)	19 MENA countries	1991–2019	Panel SURDF test with Fourier and ESTR nonlinearities	Mixed results; most countries reject hysteresis.
García-Cintado et al. (2015)	Spain	1976–2014	Unit root tests with two breaks	Supports hysteresis.

Authors (Year)	Countries	Data Period	Methodology	Key Findings
Akdoğan (2017)	31 countries (Europe, USA, Japan)	2000–2015	Linear/nonlinear unit root tests with structural breaks	Hysteresis rejected for 60% of the countries.
Yilanci et al. (2020)	G7 countries	1991–2019 (monthly)	Fourier ADF unit root test	Hysteresis found in Canada, France, and UK.
Marjanovic and Mihajlovic (2014)	OECD and CEE countries	2000–2013 (monthly)	Univariate/panel unit root tests with structural breaks	Panel results support hysteresis; structural break results do not.
Christopoulos and León-Ledesma (2007)	12 EU countries	1988Q1–1999Q4	Second-generation unit root tests	No support for hysteresis.
Pikoko and Phiri (2019)	South Africa	2008Q1–2017Q2	Individual and panel unit root tests	Evidence supports hysteresis.
Yilmaz (2023)	EU-15 and E-28	2001Q1-2019Q4	Traditional unit root tests and Fractional Frequency Fourier test of unit root	Hysteresis Hypothesis is valid in European countries.
Lee and Chang (2008)	14 OECD countries	1855-2004	Two break and one break LM unit root tests	Stationarity in unemployment and strong rejection of hysteresis.
Cuestas and Alana (2011)	CEECs countries	1998-2007 monthly data	KSS and LS unit roots along with fractional integration method	Mixed evidence of hysteresis and natural rate hypothesis based on tests used.
Ball & Onken (2021)	29 OECD Countries	2002-2019	Two-stage simple least squares	Strong evidence of unemployment hysteresis.

Source: Author's compilation

The review reveals that empirical findings on unemployment hysteresis are mixed. Studies such as Alpagut (2024) for Türkiye and the EU, Bakas and Papapetrou (2014) for Greece, and Omay et al. (2020) for the United States confirm the presence of hysteresis, implying that past unemployment levels exert lasting effects on current unemployment rates. In contrast, studies by Benati et al. (2021) and Christopoulos et al. (2007) reject the hysteresis hypothesis, supporting the notion that unemployment naturally returns to its equilibrium rate over time, consistent with the natural rate hypothesis.

Methodological variations—particularly the use of traditional versus nonlinear unit root tests, panel-based techniques, and tests with structural breaks—contribute to divergent conclusions. This underscores the importance of selecting appropriate models and data in such analyses. The findings suggest that the existence and intensity of unemployment hysteresis vary significantly depending on country-specific contexts, economic conditions, and analytical techniques.

In the case of India, research on unemployment hysteresis remains limited. Notably, there is a lack of

empirical studies using recent high-frequency quarterly data disaggregated by gender. Moreover, few studies incorporate advanced econometric techniques that account for structural breaks. This gap highlights the uniqueness and contribution of the present study in addressing a critical area of labor market dynamics and filling a significant void in the literature.

3. Data and Methodology

3.1 Data

This study utilizes quarterly macro-level data on unemployment rates in India sourced from the Periodic Labor Force Survey (PLFS), published by the National Sample Survey Office (NSSO), under the Ministry of Statistics and Programme Implementation (MOSPI), Government of India. The dataset covers the period from Q2:2018 to Q4:2024. The values for Q1 and Q2 of 2025 have been extrapolated using a standard linear extrapolation technique to complete the time series.

The unemployment rate indicators include male, female, and overall unemployment (inclusive of transgender individuals) for the population aged 15 years and above. The unemployment rate follows the Current Weekly Status (CWS) definition, which considers a person unemployed if they did not work even one hour during the reference week but were either actively seeking or available for work during that week.

3.2 Econometric Methodology

To examine the presence of hysteresis in India's unemployment rates, the study applies a range of unit root tests, including both conventional and structural break approaches, as well as variance ratio (VR) analysis. These tests are used to determine whether the unemployment rate series is stationary (supporting the natural rate hypothesis) or non-stationary (supporting hysteresis).

A. Conventional Unit Root Tests

1. **Elliot, Rothenberg, and Stock (ERS) Test**

   The ERS test enhances the augmented Dickey-Fuller (ADF) test by incorporating a quasi-differencing approach and GLS detrending. The model is estimated as:

$$y_t = \rho y_{t-1} + \epsilon_t \qquad \text{where } \varepsilon_t \sim IID(0, \sigma^2)$$

   Detrending is performed using:

$$y_t^* = y_t - \omega Z_t$$

   where Zt represents deterministic components, and **ω** is an adjustment parameter.

2. **Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) Test**

   This test evaluates the null hypothesis of stationarity. The model is:

$$y = \mu_t + \varepsilon_t,\ \mu_t = \mu_{t-1} + \eta_t$$

   The KPSS statistic is computed from partial sums of residuals to assess long-run variance.

3. **ERS-GLS Detrended Dickey-Fuller Test**

This variant improves test power by applying GLS detrending to the Dickey-Fuller regression:

$$y_t^* = \theta y_{t-1}^* + \sum_{i=1}^{p} \beta_i \Delta y_{t-i}^* + \varepsilon_t$$

4. **Ng-Perron Test**

To overcome size distortion and low power in small samples, the Ng-Perron test modifies the ADF approach by using GLS-detrended data and proposes four test statistics to determine stationarity more robustly.

These tests collectively examine whether unemployment series follow a unit root process. However, due to potential structural breaks in economic data, the study complements these with more advanced tests.

B. Unit Root Tests with Structural Breaks

Given the sensitivity of macroeconomic variables like unemployment to policy shifts, global shocks, and institutional changes, the study employs Perron's structural break unit root tests.

1. **Perron Breakpoint Unit Root Tests**

These tests incorporate structural breaks in the intercept, trend, or both. Three models are considered:

- **Model A** (Level Shift):

$$y_t = \mu_1 + \mu_2 D_t + \mathrm{p} y_{t-1} + \varepsilon_t$$

- **Model B** (Trend Shift):

$$y_t = \mu + \beta t + \theta D_t + \rho y_{t-1} + \epsilon_t$$

- **Model C** (Crash and Changing Growth):

$$y_t = \mu + \theta DU_t + \beta t + \gamma DT_t + \delta y_{t-1} + \sum_{i=1}^{k} \Upsilon_i \ \Delta y_{t-i} + \epsilon_t$$

Here, DU_t and DT_t are dummies for intercept and trend shifts, respectively.

The test results are visualized using ADF statistics and autoregressive (AR) coefficients to detect breakpoints.

4.Results and Discussion

Before conducting formal unit root tests, it is essential to graphically visualize the data series. This step helps in understanding the behavioral characteristics and statistical properties of the time series, which is crucial for interpreting unit root test outcomes. As seen in Figure 2, a prominent spike appears in the middle period of the series, indicating a significant shock to the labor market that affected all demographic groups. This spike aligns with the COVID-19 pandemic period (Q3:2020 to Q1:2021), followed by a steady decline in unemployment rates across all categories.

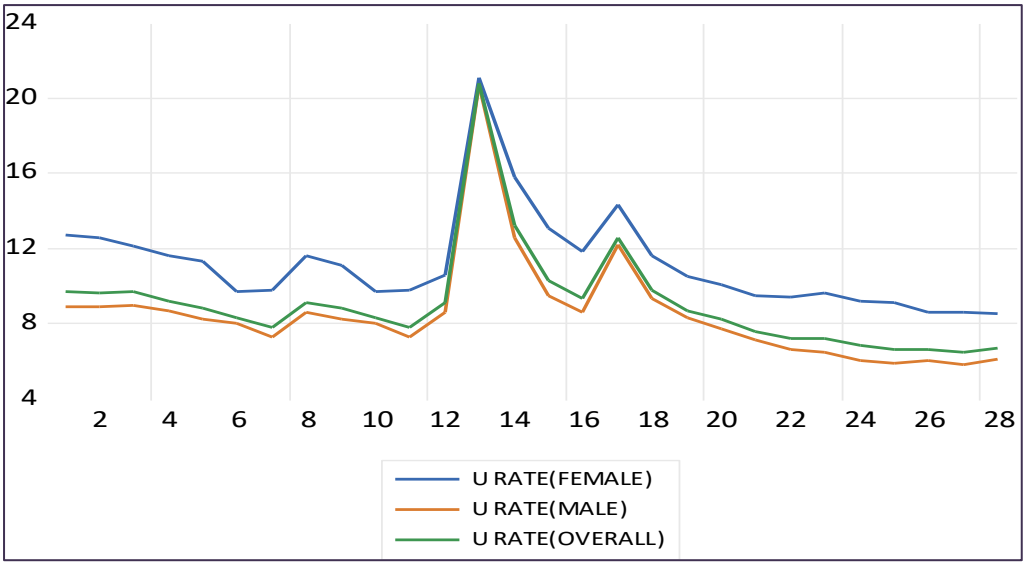


Figure 2: Trends in Unemployment Rates by Gender (Q2:2018 – Q2:2025)

Source: Author's compilation based on EViews 12 software.

The unemployment rates for all three groups show a sharp peak during the COVID-19 period, reflecting the severe disruption it caused. Notably, female unemployment remained consistently higher than male unemployment throughout the period, suggesting structural gender disparities in India's labor market. The presence of a visible trend and the sharp discontinuity implies likely non-stationarity in the data, warranting unit root testing with allowance for trends and structural breaks (e.g., ADF with trend or Perron breakpoint test). Since hysteresis is linked with non-stationarity, the graphical evidence provides initial support for its potential presence.

Table 2: Results of Conventional Unit Root Tests

ERS Test				
Significance level	Test statistic	Variable	Estimated Coefficient	Decision
1%	1.870	Urate(male)	2.274	Nonstationary (at 1%) and Stationary (at 5 &10%)
5%	2.97	Urate(female)	2.961	Nonstationary (at 1%) and Stationary (at 5% &10%)
10%	3.91	Urate(overall)	2.352	Nonstationary (at 1%) and Stationary (at 5% &10%)
KPSS Test				
1%	0.739	Urate(male)	0.251	Stationary
5%	0.463	Urate(female)	0.266	Stationary
10%	0.347	Urate(overall)	0.244	Stationary
ERS-DF-GLS Test				
1%	-2.653	Urate(male)	-3.105	Stationary
5%	-1.953	Urate(female)	-2.715	Stationary
10%	-1.609	Urate(overall)	-3.044	Stationary

Significance level	Test statistic		Variable	Estimated Coefficient		Decision
Ng Perron Test						
	MZa	MZt				
1%	-13.80	-2.58	Urate(male)	-10.788	-2.287	Stationary
5%	-8.10	-1.98	Urate(female)	-9.447	-2.103	Stationary
10%	5.70	-1.62	Urate(overall)	-10.593	-2.262	Stationary

Source: Author's compilation based on Eviews12 software.

The results in Table 2 present mixed outcomes. While the ERS test suggests non-stationarity at the 1% level for all series, it supports stationarity at 5% and 10%. The KPSS test and ERS-DF-GLS tests support stationarity across all categories. Similarly, the Ng-Perron test confirms stationarity, as MZa and MZt statistics surpass critical thresholds. These findings suggest the rejection of the null hypothesis of a unit root, implying that unemployment in India does not exhibit strong hysteresis.

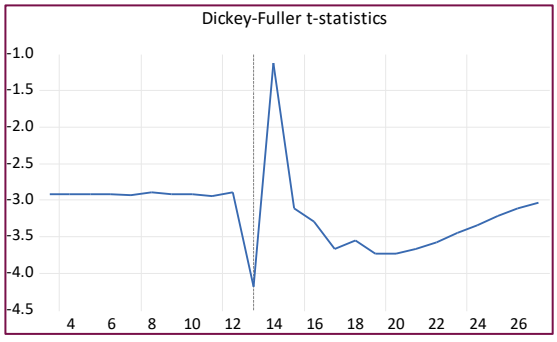
However, differences in results across tests emphasize the sensitivity of conclusions to the methodology applied. As a result, further examination using unit root tests with structural breaks is warranted.

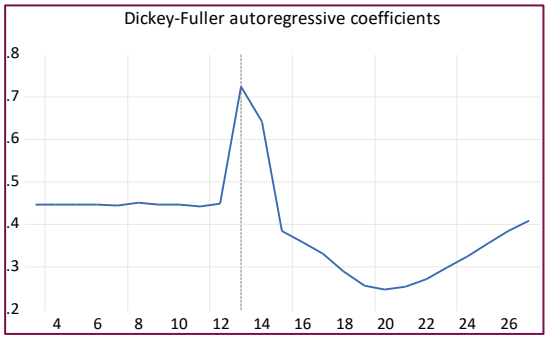
Table 3: Results of Unit Root Tests with Structural Breaks

Test statistic	Variables	Innovative Outlier	Additive Outlier	Decision
-4.949 (1%)	Urate(male)	-4.1794 (0.104)	-3.888 (0.197)	Nonstationary
-4.443(5%)	Urate(female)	-3.4395 (0.415)	-3.569 (0.137)	Nonstationary
-4.419(10%)	Urate(overall)	-4.2830 (0.077)	-3.788 (0.241)	Nonstationary

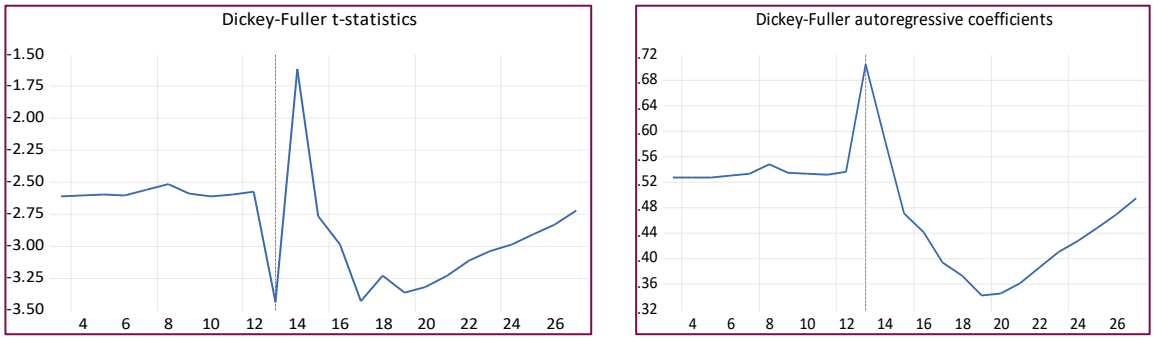
Table 3 indicates that none of the series surpass the critical values under either the innovative or additive outlier models, confirming non-stationarity when accounting for structural breaks.

(a) Unemployment rate of males





(b) Unemployment rate of females



(c) Unemployment rate (overall)

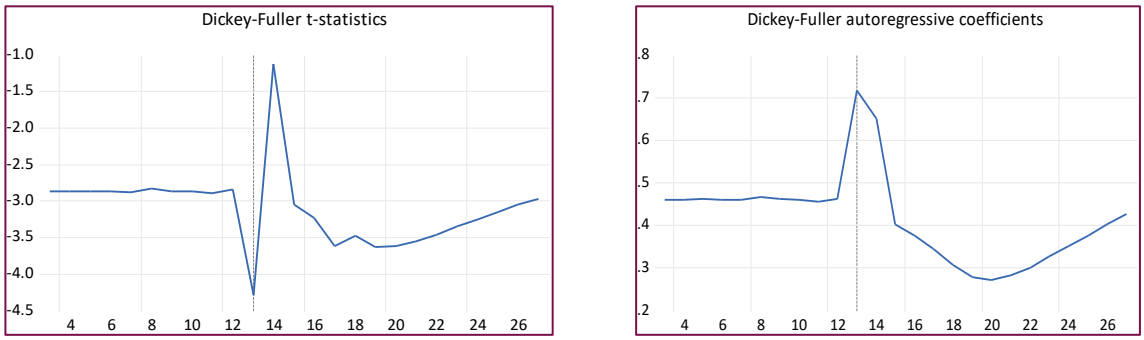


Figure 3: Structural Breaks in Unemployment Rates (a) Male Unemployment Rate (b) Female Unemployment Rate (c) Overall Unemployment Rate

Source: Author's compilation based on Eviews 12 software.

Each subfigure in Figure 3 highlights a structural break around the COVID-19 shock (2020–2021), which alters the trend and autoregressive properties of the series. The change in AR coefficients confirms a shift in data dynamics, indicating non-stationarity.

Figure 4(a): VR graph of the overall unemployment rate in India (2018-2025)

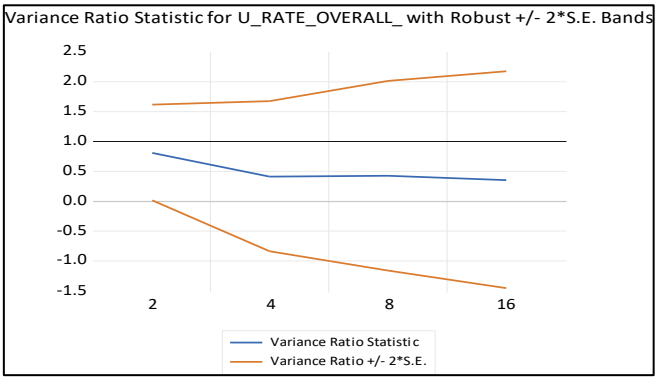


Figure 4(b): VR graph of male unemployment rate (2018-2025)

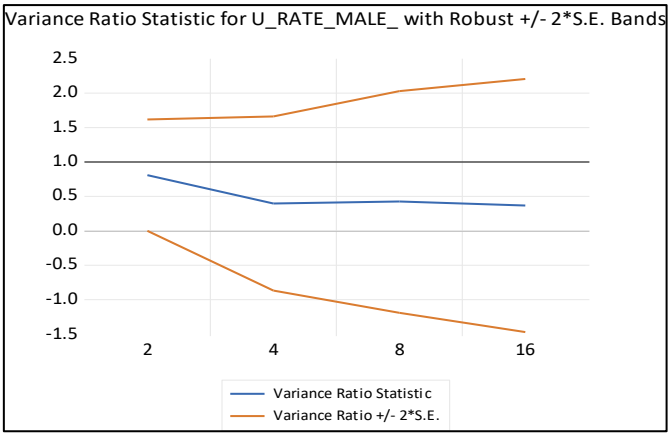


Figure 4(c): VR graph of female unemployment rate (2018-2025)

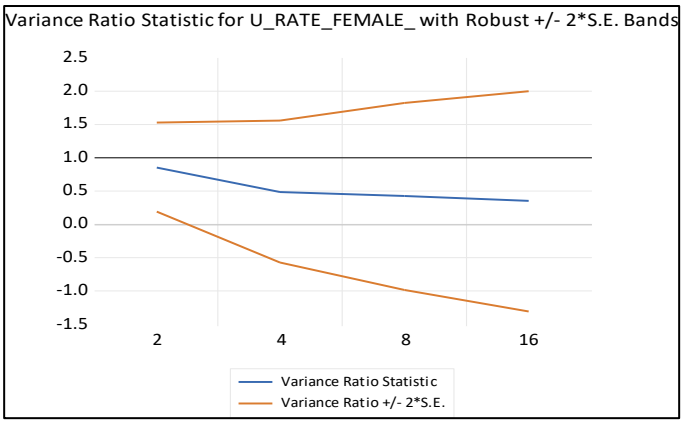


Figure 4: Variance Ratio (VR) Test Graphs (a) Overall Unemployment Rate (2018–2025)

(b) Male Unemployment Rate (2018–2025)

(c) Female Unemployment Rate (2018–2025)

Source: Author's compilation

The VR graphs further clarify the persistence properties. All VR statistics lie below 1 and fall outside the ±2 standard error bands, rejecting the strong hysteresis hypothesis. This suggests mean-reverting behavior, where unemployment gradually returns toward equilibrium post-shock.

In summary, conventional unit root tests largely support the natural rate hypothesis (NRH), while structural break models suggest weak non-stationarity. The VR results reinforce moderate mean reversion. Together, these results suggest mild hysteresis with evidence leaning towards transitory unemployment effects, consistent with studies in advanced and emerging economies such as Tiwari (2014) for Australia and Benati et al. (2021) for the U.S. Conversely, persistent hysteresis found in Greece (Bakas et al., 2014) or Turkey (Ozpence & Ergen, 2017) contrasts with India's recovery-oriented labor market.

5. Conclusion and Policy Implications

This study has addressed the critical issue of unemployment hysteresis in India's labor market through the application of conventional and breakpoint unit root tests. A comprehensive review of relevant literature

guided the analysis, which uniquely focused on India using the most recent quarterly data spanning seven years—encompassing both pre- and post-COVID-19 economic conditions. The findings predominantly support the absence of strong hysteresis effects in India's unemployment rates, as indicated by first-generation unit root tests and Variance Ratio (VR) graphs. However, structural break tests reveal some evidence of mild hysteresis. Overall, the natural rate hypothesis, which posits that unemployment tends to revert to its natural level over time, appears to hold in the Indian context.

The natural rate of unemployment is a fundamental macroeconomic concept that represents equilibrium in the labor market. It includes frictional unemployment (due to job searches and transitions) and structural unemployment (due to skill mismatches) but excludes cyclical factors. When hysteresis effects are present, temporary shocks may result in lasting increases in unemployment. However, India's relatively low persistence of shocks implies that temporary unemployment does not become entrenched.

Given these findings, timely and targeted policy interventions are crucial to prevent temporary shocks from translating into long-term unemployment. Rather than relying heavily on cyclical policies like prolonged employment subsidies or tax reliefs, India should prioritize structural reforms that enhance the adaptability of its labor market. This includes reducing job-skill mismatches and increasing labor market flexibility. Policymakers should strengthen vocational and technical training through demand-driven programs such as the Skill India Mission and Pradhan Mantri Kaushal Vikas Yojana (PMKVY), ensuring alignment with industry needs. Self-employment and entrepreneurship should be expanded through enhanced support for initiatives like the Prime Minister's Employment Generation Programme (PMEGP), Atmanirbhar Bharat Rozgar Yojana (ABRY), and Startup India. Macroeconomic tools such as fiscal and monetary policy should be carefully calibrated to promote a stable employment environment. Public spending should prioritize capacity-building over long-term welfare or subsidy-based programs.

Regarding the limitations and future research directions, the robustness of unit root test results is sensitive to model specifications, including assumptions on deterministic trends, structural breaks, and nonlinearity. The present analysis is constrained by the relatively short time series, especially focused around the COVID-19 period. Caution is warranted when generalizing findings to broader economic cycles or alternative macroeconomic conditions.

Future studies should employ more advanced methodologies, such as third-generation panel unit root tests that incorporate nonlinearities and cross-sectional dependence. Comparative cross-country analyses would also provide broader insights into the dynamics of unemployment hysteresis. Moreover, empirical evaluations of the effectiveness of policy instruments under varying economic scenarios would be valuable in guiding future labor market strategies.

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Appendix A

TIME PERIOD	U RATE(MALE)	U RATE(FEMALE)	U RATE(OVERALL)
Q2 2018	8.9	12.7	9.7
Q3 2018	8.9	12.6	9.6
Q4 2018	9	12.1	9.7
Q1 2019	8.7	11.6	9.2
Q2 2019	8.2	11.3	8.8
Q3 2019	8	9.7	8.3
Q4 2019	7.3	9.8	7.8
Q1 2020	8.6	10.6	9.1
Q2 2020	20.7	21.1	20.8
Q3 2020	12.6	15.8	13.2
Q4 2020	9.5	13.1	10.3
Q1 2021	8.6	11.8	9.3
Q2 2021	12.2	14.3	12.6
Q3 2021	9.3	11.6	9.8
Q4 2021	8.3	10.5	8.7
Q1 2022	7.7	10.1	8.2

TIME PERIOD	U RATE(MALE)	U RATE(FEMALE)	U RATE(OVERALL)
Q2 2022	7.1	9.5	7.6
Q3 2022	6.6	9.4	7.2
Q4 2022	6.5	9.6	7.2
Q1 2023	6	9.2	6.8
Q2 2023	5.9	9.1	6.6
Q3 2023	6	8.6	6.6
Q4 2023	5.8	8.6	6.5
Q1 2024	6.1	8.5	6.7
Q2 2024	5.8	9	6.6
Q32024	5.7	8.4	6.4
Q4 2024	5.8	8.1	6.4
Q12025	8.2	10.9	8.8
Q22025	8.28	10.98	8.87