

Structural Break Analysis of Deposit Growth in Cooperative Banking: Evidence from the Odisha State Cooperative Bank

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ABSTRACT

Using time-series econometric techniques, this study investigates the long-term trend and structural dynamics of deposit mobilization in the Odisha State Cooperative Bank (OSCB) from 1950 to 2023. The analysis shows a consistent upward trend in deposits, which is indicative of cooperative banking's expanding role in fostering rural savings mobilization and financial deepening. The study uses the Chow test and the Bai-Perron multiple structural break test to find structural alterations in the deposit growth pattern. The results show that deposit growth evolved through three distinct phases: an early phase of rapid expansion (1950–1960), a period of institutional consolidation and moderate growth (1961–1997), and a phase of reform-led financial deepening with improved growth (1998–2023). These findings confirm significant structural breaks around 1961 and 1998. The findings imply that deposit mobilization in cooperative banking has been greatly impacted by institutional development, financial inclusion programs, and financial sector reforms. The multiple structural break model provides the best explanation for the deposit growth trajectory, according to a model comparison using AIC and BIC. In order to further boost deposit mobilization and inclusive economic development, the study recommends policy measures for enhancing institutional capacity, digital banking outreach, and financial literacy. It also emphasizes the ongoing significance of cooperative banks in bolstering rural financial inclusion.

Keywords: Cooperative Banking, Deposit Growth, Structural Break, Financial Inclusion, Time Series Analysis, Odisha State Cooperative Bank, Financial Deepening, Econometric Analysis

1. Introduction

The cooperative banking system has long been an important pillar of India's rural financial framework, particularly in mobilizing savings from rural households and extending institutional credit to agriculture and allied activities. Since the period following independence, cooperative banks have functioned as key financial intermediaries that support rural economic development and expand access to formal financial services (Mohan, 2006; Rangarajan, 2017). Within this framework, the Odisha State Cooperative Bank (OSCB) operates as the apex cooperative banking institution in the state of Odisha, providing guidance and coordination to district central cooperative banks and

primary agricultural credit societies. Over time, OSCB has played a pivotal role in reinforcing the cooperative credit network in the state while also facilitating the mobilisation of deposits from rural and semi-urban communities.

A long-term assessment of deposit trends in the Odisha State Cooperative Bank offers meaningful insights into how cooperative banking and financial deepening have progressed within the region. An analysis of deposit data from 1950 to 2023 indicates a clear and steady upward movement, reflecting the gradual expansion of deposit mobilisation over time. Nevertheless, this growth has not been evenly distributed across the entire period. During the initial decades, deposit volumes remained

relatively modest, largely due to limited banking outreach and the early developmental stage of the cooperative banking framework. A notable acceleration in deposit growth becomes visible after the early 1990s, which corresponds with the financial sector reforms associated with the 1991 Economic Liberalization in India. These reforms contributed to stronger regulatory structures, improved institutional efficiency, and wider access to formal banking services (Mohan, 2006; Reserve Bank of India, 2022). In addition, the sharper expansion in deposits observed after 2009 can be linked to the growing influence of financial inclusion policies, technological developments in banking systems, and increased mobilisation of rural savings.

From an econometric standpoint, the deposit time series displays a strong upward trajectory that follows an exponential growth pattern rather than a simple linear trend, suggesting that the growth process may have experienced structural changes over time. To examine such potential shifts, econometric tools such as the Chow Test and the Bai–Perron Multiple Structural Break Test are commonly employed to determine whether the relationship between time and deposit growth remains stable or varies across different periods (Bai & Perron, 1998, 2003; Gujarati & Porter, 2009). Initial empirical observations point to possible structural turning points around the years 1961, 1991, and 1998. These shifts indicate that the process of deposit mobilisation has likely progressed through several distinct phases shaped by institutional development, policy reforms, and the gradual modernization of the financial system. Examining these structural transitions is therefore important for gaining a clearer understanding of the long-term evolution and performance of cooperative banking in Odisha.

1.1 Relevance and Importance of the Study

Studying deposit patterns in cooperative banking institutions is essential for gaining a deeper understanding of financial deepening and the progress of rural economic development. Deposits form the main financial base for cooperative banks, allowing them to provide credit to sectors such as agriculture, small businesses, and rural households. Consequently, analysing the behaviour and growth of deposits helps reveal how effectively cooperative financial institutions are able to mobilize savings from local communities and channel them toward inclusive economic activities (Rangarajan, 2017; Reserve Bank of India, 2022).

Although cooperative banks play a vital role within India's financial architecture, relatively few empirical studies have examined the long-term deposit behaviour of state-level cooperative banks. Much of the existing

research primarily focuses on trends in commercial banking or broader macroeconomic financial indicators, which leaves a noticeable gap in understanding how cooperative bank deposits evolve structurally at the regional level. In the context of Odisha, the Odisha State Cooperative Bank functions as an important institution linking various layers of the rural credit system. However, comprehensive econometric investigations exploring the long-term pattern and structural dynamics of its deposit growth remain limited.

To fill this identified gap, the present research undertakes a detailed examination of the long-term trend and structural changes in deposits of the Odisha State Cooperative Bank over a period spanning more than seventy years. The analysis employs a range of econometric tools—including structural break tests, model selection techniques, and dummy–interaction regression models—to investigate how policy reforms, institutional evolution, and financial sector modernization have shaped the pattern of deposit mobilisation across time. Understanding these dynamics is particularly important in the present policy environment, where financial inclusion initiatives continue to expand and cooperative banking institutions are increasingly expected to contribute to inclusive and sustainable rural development.

1.2 Research Questions

In light of the preceding discussion and the identified gap in existing literature, this study aims to analyze the long-term behaviour of deposit mobilisation in the Odisha State Cooperative Bank for the period 1950–2023. The research first examines the historical trend and growth trajectory of deposits in order to understand the changing pattern of development within the cooperative banking sector over time. It also investigates whether the deposit series experienced notable structural shifts and identifies the specific periods during which such changes occurred. Furthermore, the study assesses how broader economic reforms, institutional expansion, and financial sector modernization have shaped deposit mobilisation within cooperative banking institutions. To capture these dynamics, advanced econometric tools, including the Bai–Perron Structural Break Test, are employed to determine whether the deposit data reflects distinct growth regimes across different phases of development. Finally, the analysis considers the wider implications of these structural changes for understanding the evolution of cooperative banking and the progression of financial deepening in Odisha.

1.3 Objective and Hypotheses

The primary objective of this study is to examine the long-term trend and structural dynamics of deposit mobilisation

in the Odisha State Cooperative Bank during the period 1950–2023 using time-series econometric techniques. Specifically, the study aims to analyze the growth pattern of deposits, identify possible structural breaks in the deposit trend, and assess whether financial sector reforms and institutional developments significantly influenced deposit mobilisation over time. Based on this objective, the study tests the following hypotheses: **H₀**: Deposit growth of the Odisha State Cooperative Bank follows a stable linear trend without structural changes; **H₁**: Deposit growth exhibits significant structural breaks associated with institutional expansion, financial sector reforms, and financial deepening in India (Bai & Perron, 2003; Mohan, 2006; Reserve Bank of India, 2022).

2. Literature Review

In the field of financial development, scholars have consistently highlighted the importance of banking institutions in encouraging savings and supporting overall economic progress. An efficient banking system helps accumulate capital by collecting savings from households and directing these resources toward productive investment, which ultimately contributes to sustained economic growth and financial stability (Schumpeter, 1911; Levine, 1997). In many developing countries, financial institutions also serve a broader developmental role by promoting financial inclusion and improving economic opportunities in rural areas through expanded access to formal financial services (Mohan, 2006; Rangarajan, 2017). Within the Indian context, cooperative banks represent a vital segment of the institutional credit framework, particularly in rural and semi-urban regions where the reach of formal banking services has traditionally been limited.

A substantial body of literature emphasizes the significant role played by cooperative banking institutions in promoting deposit mobilisation and strengthening agricultural finance in rural areas. Earlier studies on cooperative banking underline their contribution to extending institutional credit to farmers and rural households, which in turn supports rural economic development and agricultural productivity (Venkiteswaran, 1979; Goyal, 1979). In addition to credit delivery, cooperative banks also carry out core banking activities including mobilizing savings, providing loans, and facilitating remittance services, thereby functioning as important channels of financial intermediation in rural economies (Reserve Bank of India, 2022). In India, the cooperative banking system is organized through a three-tier institutional framework comprising state cooperative banks at the apex level, district central cooperative banks at the intermediate level, and primary agricultural credit societies at the grassroots level. Together, these institutions form an integrated network

that extends banking and credit services to rural and semi-rural communities.

The expansion of banking services and the deepening of financial systems are widely recognized as important drivers of economic progress and inclusive growth. Studies suggest that the development of the financial sector improves the allocation of resources and strengthens the operational efficiency of financial institutions, which ultimately contributes to higher economic growth (Mohan, 2006). In a similar vein, Rangarajan (2017) highlights that broader banking outreach and stronger financial institutions play a critical role in encouraging savings and supporting inclusive development, particularly in emerging economies. In recent years, the concept of financial inclusion—referring to the provision of accessible and affordable formal financial services to disadvantaged and low-income populations—has become a major priority in India's economic policy agenda (Rangarajan, 2008; Reddy, 2007). Initiatives aimed at expanding financial inclusion seek to bring previously unbanked groups into the formal financial system, thereby enhancing deposit mobilisation and contributing to overall economic stability.

Empirical studies have also explored the linkage between financial inclusion and broader economic progress. For instance, Sarma and Pais (2011) demonstrate that the extent of financial inclusion is strongly related to key socio-economic factors such as income levels, educational attainment, and infrastructure availability. Their analysis indicates that wider access to formal financial services can significantly enhance both economic advancement and human development. In a similar vein, Collins et al. (2009) emphasize that when households have access to secure savings facilities and formal banking services, they are better equipped to manage financial uncertainties and maintain greater economic stability over the long term.

A number of policy interventions in India have played a significant role in widening the reach of banking services and strengthening the mobilisation of deposits over time. Various government initiatives—including the Lead Bank Scheme introduced in 1969, the establishment of Regional Rural Banks in 1975, the Self-Help Group–Bank Linkage Programme launched in 1992, and the Pradhan Mantri Jan-Dhan Yojana initiated in 2014—have collectively reinforced the institutional structure of financial inclusion and broadened access to formal banking facilities, particularly in rural regions (Mukhopadhyay, 2016; Rao, 2007). As a result, these policy measures have enhanced the outreach of financial institutions and contributed to a greater accumulation of deposits within the organized banking system.

Advancements in banking technology have played an

important role in enhancing deposit mobilisation and strengthening financial inclusion. The growing use of information technology, digital banking systems, and mobile-based financial services has improved the accessibility of banking facilities in rural regions while also lowering transaction costs for customers (Shroff, 2010). The integration of such technologies has further enabled banks to increase operational efficiency and extend financial services to segments of the population that previously had limited access to formal banking institutions.

An important strand of banking sector research examines how structural transformations and policy reforms influence financial institutions. The economic and financial reforms initiated in India during the early 1990s brought significant changes to the banking landscape by strengthening regulatory mechanisms, introducing stricter prudential standards, and promoting greater competition within the financial system. These reforms improved the operational efficiency of banks and supported the expansion of deposit mobilisation, thereby contributing to broader financial deepening (Mohan, 2006; Reserve Bank of India, 2022). Existing empirical studies also indicate that financial liberalization played a major role in shaping the development path of banking institutions while expanding public access to formal financial services (Levine, 2005; Demirgüç-Kunt et al., 2015).

In empirical economic research, structural break techniques are widely applied to examine long-term movements in financial time-series data. The methodological framework introduced by **Bai and Perron (1998, 2003)** provides statistical procedures for identifying multiple structural shifts in regression relationships, enabling researchers to detect changes in underlying economic dynamics across different time periods. These approaches have been extensively employed in studies of macroeconomic performance, banking sector development, and financial market behaviour to understand how policy changes or institutional developments alter growth patterns. To determine the most suitable econometric specification, researchers frequently rely on model selection criteria such as the **Akaike Information Criterion (AIC)** and the **Bayesian Information Criterion (BIC)**, which balance model fit with parsimony (Akaike, 1974; Schwarz, 1978). Moreover, incorporating dummy variables and their interaction with time trends allows econometric models to capture regime-specific shifts in both intercepts and slopes within a single analytical framework, a technique commonly used in time-series analysis (Gujarati & Porter, 2009; Wooldridge, 2013).

Although a substantial body of literature examines

financial inclusion and the development of India's banking sector, comparatively little empirical research has concentrated on the long-term behaviour of deposits in state cooperative banks. Much of the existing scholarship tends to focus on commercial banking performance or broader macroeconomic indicators, which leaves limited understanding of how cooperative bank deposits have evolved structurally at the regional level. Considering the central role played by the Odisha State Cooperative Bank in guiding and coordinating the cooperative credit framework in Odisha, studying the long-term trends and structural shifts in its deposit mobilisation can offer valuable insights into the transformation of cooperative banking and the process of financial deepening within the state.

2.1 Research Gap

Although a substantial body of literature discusses financial development, banking sector expansion, and financial inclusion in India, relatively few empirical studies have examined the long-term behaviour of deposits within cooperative banking institutions, particularly at the state level. Much of the existing research primarily focuses on the broader relationship between financial sector development and economic growth or on the performance and operations of commercial banks and nationwide financial inclusion programmes (Levine, 1997; Mohan, 2006; Rangarajan, 2017). While these contributions significantly enhance our understanding of how financial systems support economic progress, they seldom explore how deposit mobilisation in cooperative banks has evolved structurally over time, despite the continued importance of these institutions in facilitating rural financial intermediation across India.

Research focusing specifically on state cooperative banks remains limited, as much of the existing literature primarily concentrates on short-term financial indicators such as profitability levels, non-performing assets, or patterns of credit distribution. Consequently, relatively little scholarly attention has been directed toward examining the long-term behaviour and structural evolution of deposit mobilisation within cooperative banking institutions through rigorous econometric time-series analysis. Many earlier investigations tend to rely largely on descriptive statistics or basic growth calculations, rather than employing advanced econometric techniques capable of identifying structural shifts in financial data over time. Analytical tools such as the Chow Test, the Bai-Perron multiple structural break methodology, and model selection criteria including the Akaike Information Criterion and the Bayesian Information Criterion have seldom been utilized to explore long-run deposit dynamics in the cooperative banking sector.

Another notable limitation in existing research concerns the **regional perspective of cooperative banking development**. Although many studies have explored how financial sector reforms and financial inclusion policies have influenced the growth of India's banking system at the national level, comparatively little attention has been given to understanding how these broader policy and institutional changes have affected deposit mobilisation within specific state cooperative banks. In the context of the Odisha State Cooperative Bank, there is a clear lack of comprehensive econometric research examining its deposit trends over an extended historical period. This gap persists despite the bank's important contribution to mobilizing rural savings and facilitating agricultural credit within the state of Odisha.

To address the identified research gap, this study undertakes a detailed econometric investigation of the long-term trend and structural transformations in deposit mobilisation of the Odisha State Cooperative Bank during the period 1950–2023. Using time-series regression models along with advanced structural break methodologies, the analysis explores how deposit growth has evolved over time and examines the role played by institutional reforms, financial sector development, and expanding financial inclusion in shaping these dynamics. By generating empirical evidence based on a long historical dataset, the study offers a comprehensive and data-driven understanding of the evolution of cooperative banking deposits at the state level. Such an approach adds to the existing body of literature by highlighting the structural development of cooperative banking institutions in Odisha, an area that has received comparatively limited empirical attention in earlier research (Bai & Perron, 2003; Reserve Bank of India, 2022).

3. Data and Methodology

3.1 Data Source and Description

This research is based on annual time-series data on deposits of the Odisha State Cooperative Bank for the period 1950–2023. The dataset was assembled from archival cooperative banking statistics along with various reports issued by the Reserve Bank of India and other relevant institutional publications. Covering more than seventy years, the dataset offers a comprehensive foundation for analysing long-term growth trends and identifying structural changes in deposit mobilisation within the cooperative banking system of Odisha.

Bank deposits are widely regarded as a key measure of financial sector development and the expansion of banking institutions within an economy. The ability of banks to attract deposits often indicates the level

of public trust in financial institutions, the spread of banking services, and the overall progress of economic development (Mohan, 2006; Rangarajan, 2017). In the Indian context, cooperative banks perform an especially important function by encouraging savings among rural populations and providing credit support to agriculture, small farmers, and local enterprises.

An initial visual examination of the data indicates that deposits have risen rapidly over the study period, displaying a clear exponential growth trend. The upward movement becomes more pronounced after the early 1990s and accelerates further during the late 2000s. Such growth behaviour is frequently observed in banking time-series data, as the expansion of the financial system and overall economic progress tend to mutually reinforce each other by increasing savings mobilisation and strengthening the process of financial intermediation (RBI, 2022).

3.2 Econometric Model Specification

Because the deposit data display a pronounced upward trajectory that is not purely linear, the study adopts a **log-linear trend specification** to examine the growth pattern. This modelling approach is commonly applied in financial time-series analysis to approximate percentage growth rates and capture exponential expansion in economic variables (Gujarati & Porter, 2009; Wooldridge, 2013). The baseline model is specified as:

$$\ln(D_t) = \alpha + \beta_t + u_t$$

Where

D_t = deposits in year t

- t = time trend
- α = intercept
- β = trend coefficient representing the growth rate
- u_t = error term

In this specification, the coefficient β approximates the **constant percentage growth rate of deposits** over time. The semi-log form is particularly appropriate when the underlying economic process follows exponential growth.

3.3 Growth Rate Estimation

To understand long-term changes in deposit mobilisation, the study also computes **Compound Annual Growth Rate (CAGR)** and **decade-wise growth rates**. The CAGR is calculated using the standard formula:

$$CAGR = \left(\frac{D_T}{D_0} \right)^{1/n} - 1$$

where D_T is the final value, D_0 is the initial value, and n represents the number of years. This method provides a summary measure of long-run growth and allows

comparison across different time periods.

3.4 Structural Break Analysis

Financial time series often experience **structural changes due to institutional reforms, policy shifts, or economic transitions**. Therefore, the study employs several econometric techniques to detect structural breaks in deposit growth.

3.4.1 Chow Test

To examine whether the deposit growth process changed significantly around the economic reform period, the Chow Test for Structural Break was applied with a potential breakpoint at **1991**, corresponding to the 1991 Economic Liberalization in India.

The Chow test evaluates the null hypothesis of parameter stability:

$$H_0: \beta_{pre} = \beta_{post}$$

A statistically significant F-statistic indicates that the regression parameters differ across sub-periods, implying a structural shift in the deposit growth process (Gujarati & Porter, 2009).

3.4.2 Bai–Perron Multiple Structural Break Test

While the Chow test requires a **pre-specified break year**, structural shifts in long time-series data may occur at unknown points. To address this limitation, the study applies the Bai–Perron Multiple Structural Break Test, which endogenously determines breakpoints by minimizing the global residual sum of squares (Bai & Perron, 1998, 2003).

The general specification can be expressed as:

$$\ln f() (D_t) = \alpha_j + \beta_j t + u_t$$

for each regime j .

This method identifies statistically significant breakpoints and allows the growth parameters to vary across regimes. The Bai–Perron test is widely used in empirical economic research for detecting regime changes in macroeconomic and financial time series.

3.5 Bai–Perron supF Tests

To verify the statistical significance of structural breaks, two complementary tests were applied.

(i) Bai–Perron supF Test

The **supF test** evaluates the null hypothesis of no structural break against the alternative of one unknown break. A statistically significant result indicates parameter instability and the existence of a structural change in the time series (Bai & Perron, 2003).

(ii) Sequential supF Test

The **sequential supF test** further examines whether additional structural breaks exist. This test sequentially compares models with increasing numbers of breaks and identifies the optimal break structure.

3.6 Model Selection Criteria

To determine the most appropriate structural specification, the study compares competing models using:

- Akaike Information Criterion (AIC)
- Bayesian Information Criterion (BIC)

Both criteria evaluate model performance by balancing goodness of fit and model complexity (Akaike, 1974; Schwarz, 1978). Lower AIC and BIC values indicate better model performance and greater explanatory power.

3.7 Dummy Interaction Model

To formally estimate regime-specific changes in both intercepts and slopes, a **dummy interaction regression model** was estimated:

$$\ln f() (D_t) = \alpha + \beta_1 t + \delta_1 D_1 + \delta_2 D_2 + \gamma_1 (D_1 t) + \gamma_2 (D_2 t) + u_t$$

Where

- D_1 for years ≥ 1961
- D_2 for years ≥ 1998

The interaction terms allow the growth slope to vary across regimes. This approach enables estimation of **level shifts and trend changes within a unified regression framework**, which is a common econometric method for analysing structural changes in time series (Gujarati & Porter, 2009; Wooldridge, 2013).

3.8 Empirical Strategy

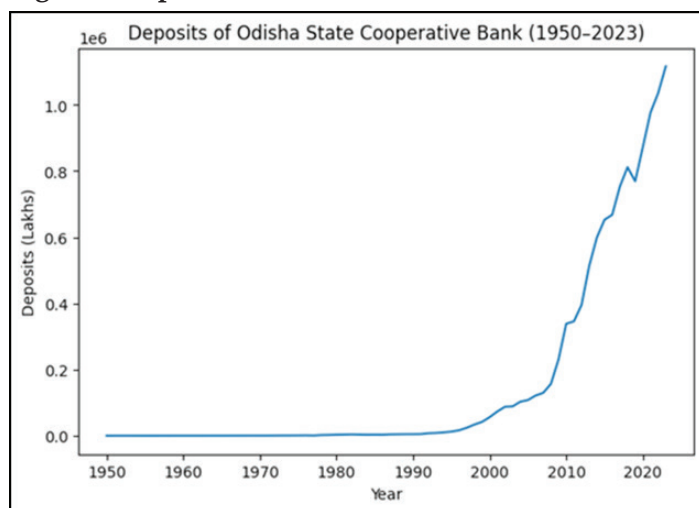
The empirical analysis therefore follows a **multi-stage econometric approach**:

1. Graphical trend analysis of deposits
2. Log-linear growth estimation
3. Decadal growth and CAGR computation
4. Chow test for reform-period structural break
5. Bai–Perron multiple structural break test
6. supF and sequential supF tests
7. Model selection using AIC and BIC
8. Dummy interaction regression for regime-specific growth dynamics

This comprehensive framework allows the study to identify long-term growth patterns, structural regime shifts, and institutional transformation in cooperative banking deposits in Odisha.

4. Trend analysis of Deposits of Odisha State Cooperative Bank

Figure 1 Deposit of OSCB from 1950 - 2023



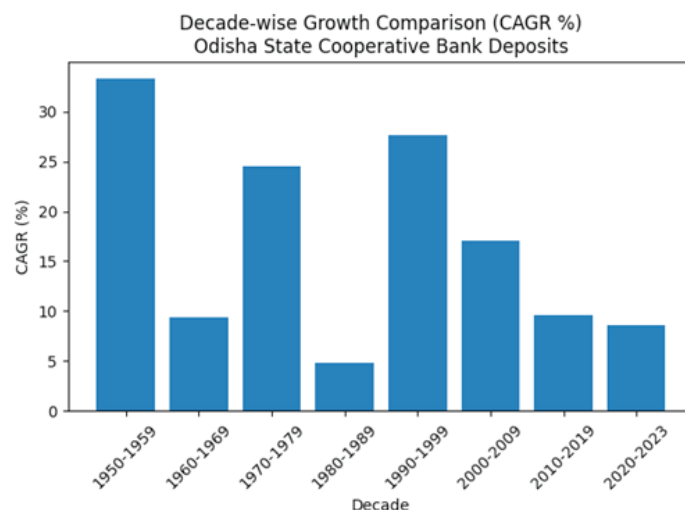
Source: Author's Own Compilation

The graphical examination of deposit data for the Odisha State Cooperative Bank between 1950 and 2023 reveals a clear and sustained upward movement, indicating progressive financial deepening and the gradual strengthening of cooperative banking institutions in Odisha. In the earlier decades, particularly from 1950 to around 1980, deposit volumes remained relatively modest and increased only slowly, reflecting the formative stage of cooperative banking and the limited reach of formal financial services in rural areas. A noticeable acceleration in deposit growth appears from the early 1990s onward. This shift coincides with broader financial sector reforms in India following the 1991 Economic Liberalization in India, which improved banking regulations, expanded financial infrastructure, and strengthened institutional efficiency. A further sharp rise is evident after 2009, suggesting the growing impact of financial inclusion programmes, expansion of digital banking services, and improved mobilisation of rural savings. The overall pattern of the graph exhibits an exponential upward movement, indicating that deposit growth has followed a nonlinear trajectory over time. This trend supports the broader theoretical perspective that expansion of banking institutions and economic development tend to reinforce each other through increased savings mobilisation and financial intermediation. Similar patterns have been highlighted in studies of cooperative banking and financial deepening in India, which emphasize the role of institutional outreach, policy reforms, and technological progress in strengthening deposit mobilisation within rural financial systems (Mohan, 2006; Rangarajan, 2017; Reserve Bank

of India, 2022). Overall, the long-term trend suggests that the bank has increasingly contributed to mobilizing rural savings and strengthening the cooperative financial network in Odisha.

5. Decade wise Growth Analysis

Figure 2 Decade wise growth



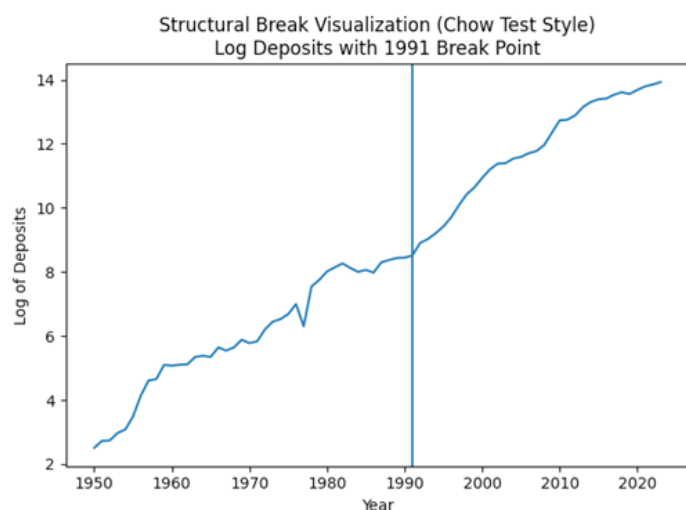
Source: Author's Own Compilation

An examination of deposits of the Odisha State Cooperative Bank across different decades shows noticeable fluctuations in the compound annual growth rate (CAGR), indicating that deposit mobilisation has been shaped by institutional developments and policy changes within the cooperative banking system. The data reveal very rapid growth during the decade 1950–1959, with deposits increasing at roughly 33 percent annually. This strong expansion largely reflects the early stage of cooperative credit development in post-independence India, when cooperative institutions were actively promoted to mobilize rural savings. In contrast, the growth rate declined during 1960–1969 to around 9 percent, suggesting a period of consolidation as cooperative institutions stabilized their operations. Deposit mobilisation accelerated again during 1970–1979, reaching approximately 24 percent, which may be associated with strengthened rural credit policies and the expansion of cooperative banking networks. However, the decade 1980–1989 recorded the slowest growth, around 5 percent, indicating institutional constraints and relatively weaker financial mobilisation during that period. A strong revival is visible in the 1990–1999 decade, when growth rose to nearly 27 percent, coinciding with the wider banking sector reforms introduced after the 1991 Economic Liberalization in India, which improved efficiency, regulation, and deposit mobilisation within the financial system. Deposit growth remained relatively

strong during 2000–2009 at about 17 percent, supported by expanding banking services and improved financial outreach. Although the growth rate moderated during 2010–2019 (around 9 percent) and 2020–2023 (around 8 percent), the overall deposit volume continued to rise significantly. This pattern reflects the increasing maturity of the cooperative banking system along with the expanding role of financial inclusion initiatives and banking technology in strengthening deposit mobilisation in India (Mohan, 2006; Rangarajan, 2017; Reserve Bank of India, 2022).

6 Structural Break Visualisation

Figure 3 Structural Break Visualise



Source: Author's Own Compilation

The graphical representation of the logarithmic deposit series of the Odisha State Cooperative Bank for the period 1950–2023 indicates a noticeable change in the pattern of growth around 1991, as marked by the break line in the figure. Before this period, the log-transformed deposit trend rises slowly and steadily, reflecting the formative phase of cooperative banking in which financial outreach in rural regions remained relatively limited. After 1991, however, the slope of the trend becomes distinctly steeper, indicating a more rapid expansion in deposit mobilisation. This shift can be associated with the broader economic transformation triggered by India's financial sector reforms during the early 1990s, which strengthened banking regulations, improved institutional efficiency, and widened the scope of financial services. From an econometric perspective, such a change suggests the presence of a structural break, implying that the relationship between time and deposit growth differs across the pre- and post-reform periods. The sharper upward movement observed after 1991 reflects enhanced financial deepening, greater

mobilisation of rural savings, and improved access to banking services through cooperative institutions. Earlier research on India's banking sector also indicates that liberalization policies and financial reforms played a significant role in strengthening deposit growth and expanding financial inclusion (Mohan, 2006; Rangarajan, 2017; Reserve Bank of India, 2022). Consequently, the graphical evidence supports the argument that policy reforms and institutional modernization contributed substantially to the improved growth trajectory of cooperative bank deposits in Odisha.

6.1 Chow Test

Table 1 Chow Test Result

Break Year	F-Statistic	df1	df2	Exact p-value
1991	3.8873	2	70	0.025067

Source: Author's Own Estimation

To determine whether a major shift occurred in the deposit growth pattern of the Odisha State Cooperative Bank around 1991, a Chow Test for structural stability was conducted. The test generated an F-statistic of 3.8873 with degrees of freedom (2, 70) and a p-value of 0.0251, which is statistically significant at the 5 percent level. This outcome leads to the rejection of the null hypothesis that the model parameters remained constant over time, indicating that a structural change occurred around 1991. In practical terms, this means that the relationship between time and deposit growth altered noticeably after that year. The timing of this break corresponds with the economic reforms introduced during the 1991 Economic Liberalization in India, which brought substantial transformations to the financial sector, including deregulation of banking activities, strengthening of prudential regulations, increased competition among financial institutions, and expansion of banking services. These reforms improved the efficiency and credibility of the banking system, encouraging higher public participation and greater savings mobilisation. Cooperative banking institutions also benefited from improved regulatory frameworks, broader rural outreach, and the expansion of financial inclusion initiatives during the reform period. Consequently, the trajectory of deposit growth became significantly steeper after 1991 compared with the earlier phase. Similar patterns have been documented in earlier studies, which highlight that financial liberalization and institutional reforms play a critical role in strengthening deposit mobilisation and promoting financial deepening in developing economies (Mohan, 2006; Rangarajan, 2017; Reserve Bank of India, 2022). Overall, the econometric evidence indicates that the reform period of 1991 marked a significant turning

point in the long-term growth dynamics of cooperative bank deposits in Odisha.

6.2 Multiple Structural Break

Table 2 Bai–Perron Test Result

Using a global RSS minimization approach (log-linear model), two statistically optimal breakpoints were endogenously identified.

Regime	Trend Coefficient (β)	Annual Growth Rate (%)	R ²
1950–1960	0.2945	34.24%	0.9529
1961–1997	0.1333	14.26%	0.9611
1998–2023	0.143	15.37%	0.9675
Breakpoint 1		Breakpoint 2	
1961		1998	

Source: Author's Own Estimation

The application of the Bai–Perron Structural Break Test offers valuable insights into the long-term behaviour of deposits of the Odisha State Cooperative Bank by identifying statistically significant structural shifts within the time-series data. Using a method that determines breakpoints endogenously through the minimization of the overall residual sum of squares, the test allows the data itself to reveal changes in the growth pattern rather than relying on pre-selected break years (Bai & Perron, 1998, 2003). The empirical results indicate two major breakpoints, occurring in 1961 and 1998, which divide the deposit series into three distinct growth phases.

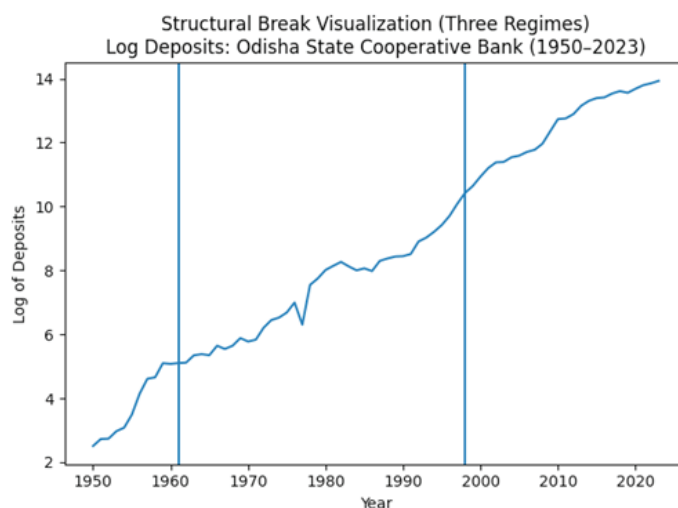
During the first phase (1950–1960), the estimated trend coefficient ($\beta = 0.2945$) corresponds to a very high annual growth rate of about 34.24 percent. This rapid increase largely reflects the initial expansion of cooperative credit institutions in the post-independence period, when cooperative banks were actively promoted to mobilize rural savings and support agricultural financing. The second phase (1961–1997) records a comparatively moderate yet stable growth rate of around 14.26 percent ($\beta = 0.1333$) with a strong explanatory power ($R^2 = 0.9611$). This period represents a stage of institutional consolidation marked by gradual strengthening of cooperative banking structures, improved regulatory arrangements, and a steady expansion of rural credit networks. The break around 1961 may therefore be associated with the transition from early expansion to a more stable phase of institutional development within the cooperative credit system.

The third phase (1998–2023) demonstrates a renewed increase in deposit growth, with an annual rate of approximately 15.37 percent ($\beta = 0.143$) and the highest goodness of fit ($R^2 = 0.9675$). This improvement can be

linked to broader developments in the Indian financial system, including the consolidation of financial sector reforms, technological modernization of banking operations, and the expansion of financial inclusion initiatives during the late 1990s and early twenty-first century. Overall, the results indicate that deposit mobilisation in the cooperative banking sector has evolved through several structural stages rather than a single reform-related transition. These patterns highlight the cumulative influence of institutional development, policy interventions, and financial deepening on the growth trajectory of cooperative bank deposits in India, which is consistent with findings reported in earlier studies on banking sector transformation (Bai & Perron, 2003; Mohan, 2006; Reserve Bank of India, 2022).

6.3 Three Regimes Structural Break

Figure 4 Three Regimes Structural Break



Source: Author's Own Compilation

The graphical representation of the logarithmic deposit series of the Odisha State Cooperative Bank for the period 1950–2023 indicates the existence of three clearly distinguishable growth phases. These phases correspond to statistically significant structural breakpoints around 1961 and 1998, which were detected using the Bai–Perron Multiple Structural Break Test. During the first phase (1950–1960), the log trend displays a sharp upward slope, suggesting exceptionally rapid growth in deposits. This pattern reflects the initial expansion of cooperative credit institutions in the early post-independence era, when cooperative banks were actively promoted to mobilize rural savings and provide credit to the agricultural sector. The second phase (1961–1997) is characterized by a comparatively gentler but consistent upward movement, indicating a period of institutional stabilization and gradual expansion of cooperative banking activities

under supportive rural credit policies. In contrast, the third phase (1998–2023) again demonstrates a stronger upward trajectory, pointing to renewed acceleration in deposit mobilisation. This growth is likely associated with financial sector modernization, wider banking outreach, and the strengthening of financial inclusion programs in India. The break around 1998 may also reflect the longer-term effects of reforms introduced after the 1991 Economic Liberalization in India, combined with technological improvements in the banking system and expanded access to financial services. Overall, the evidence suggests that deposit growth followed a multi-phase structural pattern rather than a single continuous trend, shaped by evolving institutional frameworks, policy reforms, and the broader process of financial deepening in the Indian banking sector (Bai & Perron, 2003; Mohan, 2006; Reserve Bank of India, 2022).

6.4 supF Test

Table 3 supF Test Result

(Endogenous Single-Break Test – Log Linear Trend Model)

Test Type	Maximum F-Statistic	Estimated Break Year	df1	df2	Approx. p-value
supF (1-break Bai–Perron type)	11.9951	1998	2	70	0.000033

Source: Author's Own Estimation

The application of the Bai–Perron supF structural break test to the log-linear deposit growth model of the Odisha State Cooperative Bank indicates the presence of a statistically meaningful change in the deposit growth process around 1998. The computed F-statistic of 11.9951, together with a very small p-value (0.000033), leads to a clear rejection of the null hypothesis that the model parameters remained stable over time. This result suggests that the pattern of deposit growth experienced a notable shift during the study period. The structural change observed in the late 1990s may be associated with the broader transformation of India's financial system following the reforms initiated during the early 1990s, which led to improvements in banking regulation, expansion of cooperative banking institutions, technological modernization, and wider financial inclusion efforts. These developments likely enhanced public confidence in formal financial institutions and contributed to stronger deposit mobilisation. Similar structural adjustments in banking time-series have been documented in the literature, where institutional reforms and financial deepening are shown to influence the long-

term trajectory of deposit growth (Bai & Perron, 2003; Mohan, 2006; Reserve Bank of India, 2022).

6.5 Bai–Perron Sequential supF Test

Table 4 supF Test Result

Test Type	Optimal Break 1	Optimal Break 2	F-Statistic	df 1	df 2	Approx. p-value
supF (2 breaks 1 break)	1961	1998	23.1097	2	68	< 0.000001

Source: Author's Own Estimation

The findings obtained from the Bai–Perron Sequential supF Test demonstrate that the specification allowing two structural breaks provides a better statistical explanation of the deposit growth pattern than the model with only a single break. The test identifies two important turning points in the deposit series of the Odisha State Cooperative Bank, occurring in 1961 and 1998. The high F-statistic (23.1097) together with an extremely small probability value ($p < 0.000001$) leads to a clear rejection of the null hypothesis that a single-break model is sufficient to explain the observed data. This evidence indicates that the long-term growth of deposits progressed through three distinct phases rather than one simple reform-related shift. The first structural change around 1961 appears to mark the movement from the initial rapid expansion of cooperative banking institutions to a period of institutional consolidation and stabilization associated with evolving agricultural credit policies and cooperative development initiatives. The second break around 1998 likely reflects the broader effects of financial sector modernization and the continued implementation of reforms initiated after the 1991 economic liberalization, which strengthened banking efficiency, widened financial outreach, and enhanced deposit mobilisation. Overall, the results suggest that policy reforms, institutional evolution, and increasing financial deepening significantly influenced the long-run trajectory of cooperative bank deposits in Odisha. Similar patterns of multiple regime shifts in financial time-series data have been documented in previous empirical studies on banking sector transformation and financial development (Bai & Perron, 2003; Mohan, 2006; Reserve Bank of India, 2022).

6.6 Model Comparison Using AIC and BIC

Table 5 AIC and BIC

Model	Number of Parameters	AIC	BIC
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0 Break (No Structural Change)	2	-142.88	-138.27
1 Break (1998)	4	-160.68	-151.47
2 Breaks (1961, 1998)	6	-195.06	-181.24

Source: Author's Own Estimation

A comparative evaluation of alternative econometric specifications using the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) demonstrates that the model incorporating two structural breaks offers the most appropriate statistical explanation of the deposit growth behaviour of the Odisha State Cooperative Bank. In model selection, smaller values of AIC and BIC generally imply a more desirable balance between explanatory accuracy and model simplicity (Akaike, 1974; Schwarz, 1978). In the present analysis, the specification with two breakpoints (AIC = -195.06; BIC = -181.24) performs considerably better than both the model assuming no structural change and the alternative with a single break in 1998. This improvement suggests that accounting for structural shifts substantially enhances the model's ability to capture the underlying deposit growth process. The findings indicate that the deposit trajectory of the bank evolved through three separate phases, with significant turning points occurring around 1961 and 1998. These transitions likely correspond to key stages in the development of cooperative banking, including early institutional expansion, a prolonged phase of consolidation, and a later period marked by stronger financial deepening during the reform and post-reform era. Such changes can be associated with broader transformations in India's financial system, the widening network of rural credit institutions, and improvements in banking infrastructure that have strengthened deposit mobilisation and overall banking sector development (Bai & Perron, 2003; Mohan, 2006; Reserve Bank of India, 2022).

6.7 Full Dummy Interaction Model (Single Regression)

$$\ln(D_t) = \alpha + \beta_1 t + \delta_1 D_1 + \delta_2 D_2 + \gamma_1 (D_1 \cdot t) + \gamma_2 (D_2 \cdot t) + u_t$$

Where:

- $D_1 = 1$ for years ≥ 1961
- $D_2 = 1$ for years ≥ 1998
- Interaction terms allow slope changes across regimes

Table 6 Regression Results

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Constant	1.9696	0.1665	11.8291	0
Trend (t)	0.2945	0.0246	11.9948	0

$D_1 (\geq 1961)$	1.3302	0.209	6.3657	0
$D_2 (\geq 1998)$	0.3861	0.4358	0.8858	0.378841
$D_1 \times t$	-0.1612	0.0249	-6.4813	0
$D_2 \times t$	0.0097	0.0078	1.2382	0.219908

Source: Author's Own Estimation

The dummy–interaction regression estimated for the logarithmic deposit series of the Odisha State Cooperative Bank reveals clear evidence of structural changes in the long-term deposit growth pattern. The estimated baseline time-trend coefficient ($\beta_1 = 0.2945$) reflects a very strong expansion of deposits during the early phase from 1950 to 1960. The first dummy variable ($D_1 \geq 1961$) is positive and statistically significant, while its interaction with the time trend ($D_1 \times t$) carries a significant negative coefficient. This combination suggests that after 1961 there was a noticeable upward shift in the level of deposits but a slowdown in the growth rate, indicating a transition from the rapid expansion phase of the cooperative banking system to a period of institutional stabilization and consolidation. In comparison, the second dummy variable representing the post-1998 period shows a positive shift in the level of deposits, yet the associated interaction term with the trend is not statistically significant. This outcome implies that although deposits increased during the post-1998 period, the change in the growth slope was relatively modest rather than representing a major structural acceleration. From an econometric standpoint, incorporating dummy variables together with interaction terms allows the regression model to capture different intercepts and slopes across time periods within a single specification, which is a commonly used technique for detecting structural shifts in time-series relationships (Gujarati & Porter, 2009; Wooldridge, 2013). Taken together, these findings support the existence of three distinct phases in deposit mobilisation—an initial phase of rapid expansion, a prolonged period of consolidation beginning in 1961, and a later stage of moderate growth improvement after 1998 associated with financial sector modernization and broader banking outreach in India (Bai & Perron, 2003; Reserve Bank of India, 2022).

7. Discussion and Findings

The empirical investigation of deposit mobilisation in the Odisha State Cooperative Bank during the period 1950–2023 provides important insights into the long-term development of cooperative banking and the process of financial deepening in Odisha. The graphical trend and semi-log growth analysis indicate that deposits have expanded steadily with a clear exponential pattern over the past seven decades. This pattern is consistent

with the broader theoretical view that the expansion of banking institutions and financial systems strengthens savings mobilisation and supports capital formation in developing economies (Schumpeter, 1911; Levine, 1997). The continuous rise in deposits also highlights the growing importance of cooperative banking institutions in channeling rural savings and supporting agricultural and rural credit activities. Similar conclusions have been noted in earlier studies, which emphasize that the expansion of financial institutions and improved banking outreach significantly contribute to savings mobilisation and financial deepening in emerging economies (Mohan, 2006; Rangarajan, 2017).

The analysis of decade-wise growth patterns shows that deposit expansion in the Odisha State Cooperative Bank has not followed a uniform trajectory over time; rather, it has fluctuated across different historical phases. The notably high growth recorded during the 1950s can largely be attributed to the initial expansion of cooperative credit institutions in the years following India's independence. In contrast, the slower pace of growth during the 1960s and 1980s appears to reflect phases of institutional adjustment, consolidation, and certain operational limitations within the cooperative banking structure. These observations are consistent with earlier scholarship on cooperative banking in India, which notes that the sector experienced a rapid expansion in its early years before moving into periods of consolidation and restructuring (Venkiteswaran, 1979; Goyal, 1979). A marked acceleration in deposit growth during the 1990s coincides with the broader economic transformation triggered by the 1991 Economic Liberalization in India, which introduced major reforms in the financial sector and strengthened the efficiency and competitiveness of banking institutions. Existing studies indicate that these reforms, along with improved regulatory mechanisms, enhanced public trust in formal financial institutions and significantly boosted deposit mobilisation across India's banking system (Mohan, 2006; Reserve Bank of India, 2022).

Econometric examination of structural breaks offers clearer understanding of how deposit growth has changed over time. The results of the Chow test reveal a statistically meaningful break around 1991, suggesting that the association between the time trend and deposit expansion shifted noticeably following the implementation of major financial sector reforms in India. This observation aligns with earlier empirical research indicating that liberalization policies significantly influenced banking sector performance and contributed to greater financial deepening (Levine, 2005; Demirgüç-Kunt et al., 2015). However, applying the more sophisticated Bai–Perron Multiple Structural

Break Test uncovers a more detailed pattern of change, identifying two internally determined breakpoints in 1961 and 1998. These findings imply that the trajectory of deposit mobilisation did not change only once due to reforms, but instead progressed through three separate phases of economic and institutional transformation.

The analysis reveals three distinct phases in the evolution of deposit growth. The initial phase (1950–1960) demonstrates extremely rapid expansion in deposits, which can be linked to the formative years of cooperative banking when institutions were actively encouraged to mobilize rural savings and support agricultural credit needs. The subsequent phase (1961–1997) reflects a period of relatively steady but moderate growth, indicating a stage of institutional stabilization and gradual strengthening of the cooperative banking structure. In contrast, the final phase (1998–2023) records a renewed rise in deposit mobilisation, likely influenced by improvements in the financial system, wider financial inclusion initiatives, and the increasing adoption of modern banking technologies. Overall, these patterns correspond with existing empirical research indicating that policy reforms, financial sector development, and technological progress play an important role in shaping the growth dynamics of banking institutions and financial intermediation processes (Sarma & Pais, 2011; Mukhopadhyay, 2016).

Additional econometric validation using the **Bai–Perron supF test** and the **sequential supF procedure** provides strong evidence of multiple structural changes within the deposit time series. The sequential test indicates that a model incorporating two structural breaks offers a statistically better fit than a model with only one break, thereby revealing the presence of three separate phases in the evolution of deposit growth. Furthermore, model evaluation based on the **Akaike Information Criterion (AIC)** and the **Bayesian Information Criterion (BIC)** confirms that the two-break specification explains the observed deposit dynamics more effectively than alternative models. These findings are consistent with established econometric research, which suggests that financial time-series data frequently undergo regime shifts as a result of policy reforms, institutional adjustments, and technological progress (Bai & Perron, 2003; Gujarati & Porter, 2009).

The results obtained from the dummy–interaction regression model provide additional evidence of structural variations in both the intercept and the trend growth rate across different time periods. The statistically significant coefficient linked to the structural break around 1961 indicates a transition from the initial rapid expansion stage of cooperative banking to a comparatively stable phase of institutional development.

Furthermore, the adjustment observed after 1998 reflects a moderate revival in the pace of deposit mobilisation. Although the estimated slope change in the post-1998 period does not appear statistically strong, the positive shift in the level of deposits indicates growing public trust in cooperative banking institutions and a broader expansion of financial services following the consolidation of financial sector reforms.

Overall, this study adds to the existing body of research by offering long-term empirical insights into how cooperative bank deposits have evolved structurally at the state level. Unlike many previous studies that primarily examine national banking patterns or focus on commercial banks, this analysis emphasizes the significant role played by cooperative banking institutions in mobilizing rural savings and expanding financial access in regional economies. The findings suggest that policy reforms, financial inclusion programmes, and advances in banking technology have collectively contributed to improving deposit mobilisation within India's cooperative banking framework (Mohan, 2006; Rangarajan, 2017; Reserve Bank of India, 2022).

Accordingly, the study finds that the deposit growth of the Odisha State Cooperative Bank has progressed through three major phases: an initial stage of rapid expansion, a subsequent period of institutional stabilization, and a later phase characterized by reform-led financial deepening. These phases collectively mirror the wider changes that have occurred in India's financial system and the evolving structure of rural banking over time.

8. Policy Implications

The results of this analysis provide several meaningful policy insights for improving the performance of the cooperative banking sector in Odisha. The sustained and rapid rise in deposits of the Odisha State Cooperative Bank suggests that cooperative institutions continue to play a vital role in attracting rural savings and expanding access to formal financial services. At the same time, the identification of structural changes around 1961 and 1998 indicates that shifts in institutional frameworks, public policies, and technological progress have had a considerable impact on the pattern of deposit mobilisation. In light of this, policymakers should prioritize strengthening the institutional capacity of cooperative banks by upgrading infrastructure, enhancing governance standards, and ensuring effective regulatory supervision. Expanding digital banking facilities and modern financial technologies may also improve efficiency and increase public trust in cooperative institutions. Furthermore, broader financial inclusion strategies—such as deeper collaboration with

self-help groups, stronger connections with rural credit agencies, and the promotion of financial literacy among rural households—can help encourage higher levels of savings mobilisation. Together, these initiatives can enable cooperative banks to contribute more effectively to agricultural financing, rural enterprise development, and inclusive economic growth in Odisha, aligning with wider policy perspectives on financial deepening and rural banking advancement (Mohan, 2006; Rangarajan, 2017; Reserve Bank of India, 2022).

9. Conclusion

This study investigates the long-term behaviour and structural evolution of deposit mobilisation in the Odisha State Cooperative Bank during the period 1950–2023 using time-series econometric methods. The empirical results indicate a pronounced upward trajectory in deposits over the last seven decades, suggesting that cooperative banking institutions have increasingly contributed to the mobilisation of rural savings and the process of financial deepening in Odisha. The econometric investigation further identifies statistically significant structural changes around 1961 and 1998, implying that the growth pattern of deposits progressed through three major stages: an initial period of rapid expansion, a prolonged phase of institutional stabilization, and a later phase of renewed growth associated with financial sector reforms, modernization of banking systems, and expanding financial inclusion initiatives. These findings demonstrate that institutional transformation, policy interventions, and technological progress have played a crucial role in shaping the long-term dynamics of deposit mobilisation within the cooperative banking sector. By offering systematic empirical evidence on the historical evolution of cooperative bank deposits at the state level, the study adds to the existing body of literature and highlights the continuing relevance of cooperative banking institutions in strengthening rural financial inclusion and supporting sustainable economic development in India.

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