

ISSN No. 2454 - 1427

CDE
September 2026

**Spatial, Seasonal and Temporal Dynamics of PMFBY Performance in
Rajasthan: Evidence from District-Level Panel Data**

Nidhi Gupta

Email: nidhi.gupta@srcc.du.ac.in
Shri Ram College of Commerce

Dharmveer

Email: dharmveer@econdse.org
Department of Economics,
Delhi School of Economics

[Working Paper No. 368](#)

Centre for Development Economics
Delhi School of Economics
Delhi- 110007

Spatial, Seasonal and Temporal Dynamics of PMFBY Performance in Rajasthan: Evidence from District-Level Panel Data.

Nidhi Gupta^{a*} and Dharmveer^b

^a*Assistant Professor, Department of Economics, Shri Ram College of Commerce & Doctoral candidate, Department of Economics, Delhi School of Economics, University of Delhi, Delhi, India;*

^b*Assistant Professor, Department of Economics, Delhi School of Economics, University of Delhi, Delhi, India.*

Corresponding author: *Nidhi Gupta, Assistant Professor, Department of Economics, Shri Ram College of Commerce & Doctoral Candidate, Department of Economics, Delhi School of Economics, University of Delhi, Delhi, India.

Email: nidhi.gupta@srcc.du.ac.in; nidhi@econdse.org

Spatial, Seasonal and Temporal Dynamics of PMFBY

Performance in Rajasthan:

Evidence from District-Level Panel Data

Abstract

This paper examines the spatial and temporal patterns of the Pradhan Mantri Fasal Bima Yojana (PMFBY) in Rajasthan, analysing a district-level balanced panel spanning from 2018-19 to 2025-26. It highlights seasonal variations, district-level disparities, farmer groups, and the transition to voluntary enrolment after the 2020 policy reform. We combine descriptive analysis with two-way fixed-effects panel regressions with visual depiction by using trend analysis. Descriptive results show Rajasthan consistently outperforms the national average in terms of area penetration and the ratio of farmer-benefited whereas participation by non-loanees remains persistently low in comparison to other states. Significant spatial and seasonal differences are evident: a distinct West-East divide, with Western Rajasthan generally outperforming Eastern Rajasthan on PMFBY indicators. Additionally, the Kharif season faces higher production risk and claim rates than Rabi. Panel estimates show that future enrolment tends to increase with the number of farmers benefited by prior claim payouts but decreases as the total value of claims paid rises. This pattern is mainly observed among loanee applicants and is largely absent among non-loanee applicants. Interaction analyses reveal that Western Rajasthan exhibits stronger claim responses whereas Eastern Rajasthan displays weaker or even opposite responses. The post-2020 trend analysis shows continued participation following the transition to voluntary enrolment, with a particularly pronounced increase in loanee applications. Western Rajasthan also exhibits stronger post-2020 participation dynamics than Eastern Rajasthan. Overall, the evidence indicates that PMFBY's performance in Rajasthan is not attributed only to climatic and agricultural risks; it is also influenced by farmers' experiences with the scheme and notable regional

disparities in coverage. The results highlight the need to tailor implementation strategies for different regions, improve claim settlement processes and promote voluntary participation among non-loanee farmers.

KEYWORDS: Pradhan Mantri Fasal Bima Yojana(PMFBY); Crop Insurance; Agricultural risk; panel data; regional heterogeneity; farmer enrolment.

JEL Classification: Q14, Q18, G22, C23, R12.

1. Introduction

Agriculture and allied activities is an important sector in India's growth trajectory. This sector contributes one-fifth of the country's national income at current prices, and accounts for 46.1 % of India's working population (Government of India, 2026). However, farmers' incomes and rural livelihoods are highly vulnerable to climate uncertainties such as droughts, floods, hailstorms, pest infestations and extreme weather events. Around 60 % of India's mainland is rainfed, making the southwest monsoon the prime driver of food security, the economy and social stability of the nation. Over the years, climate change has significantly intensified the severity of these unpredictable weather events (IPCC, 2021). In 2025, most states in India saw abundant rainfall in May, breaking many years' records. By August, this trend reversed with 19 % of the country experiencing drought or drought-like conditions (Afreen & Mishra, 2025). There has been an increase in global temperatures over the years. Warmer air holds more moisture, leading to heavy, intense rainfall and increasing the incidence of flash floods. The soil cannot absorb water quickly, leading to the washing off of agricultural produce and infrastructure, thus negatively impacting livelihoods (Highland Post, 2026).

Apart from production risk, farmers also face other risks such as price risk, financial risk, institutional risk, technology risk, personal risk and resource risk (FAO, 2013; Ullah et al., 2016). These risks further enhance the variability and uncertainty of farmers' income. Uncertain income and crop failure lead to reduced investment and capital

formation in agriculture, lower consumption, reduced spending on health and education and increased dependence on informal loans and indebtedness (Raju & Chand, 2008). To tackle these agricultural risks, farmers employ many informal risk management strategies such as crop diversification, mixed farming, spatial diversification, crop sharing, buffer stocks, sale of assets, reallocation of labour and migration. But these informal practices often fall short in addressing these risks (Hazell, 1992; Swain, 2014).

Crop Insurance has emerged as an important risk management strategy to shield farmers from financial losses caused by unpredictable weather events thus stabilising farmers' income (World Bank, 2018). The formal crop insurance scheme was first implemented in 1972 on an individual basis. Several schemes have been implemented since then, and although they improved the institutional framework for crop insurance, they suffered from several operational limitations such as low insurance penetration, delayed claim settlement, inadequate risk coverage, limited awareness and poor participation of non-loanee farmers (Mishra, 1994; Singh & Agrawal, 2020; Tiwari et al., 2020; Swain, 2023).

To address these shortcomings, the Government of India introduced the Pradhan Mantri Fasal Bima Yojana (PMFBY) in 2016, replacing all the previous schemes. The Restructured Weather-Based Crop Insurance Scheme (RWBCIS) replaced the original WBCIS and remains part of the comprehensive PMFBY framework, offering weather index insurance. The PMFBY scheme emphasises comprehensive risk coverage, technology-driven assessment, and income stabilisation for farmers (MoAFW, 2016). The performance of PMFBY has varied significantly across states, despite its impressive scale and extensive coverage. Substantial regional disparities were observed in insurance coverage and programme outcomes, largely due to differences in agro-climatic conditions, cropping patterns, institutional capacity, awareness levels, administrative efficiency and state government participation (Tiwari et al., 2020; Kapadia & Swain, 2020; Singh & Agrawal, 2020; Kaur et al., 2021; Sheoran & Kait, 2023; Kaur et al., 2024).

1.1 Background

Rajasthan is India's largest state by area, covering 10.4% (342.239 lakh ha) of the country's total geographical area. Located in the northwestern region of the country, the state extends between 23°3' to 30°12' N and 69°30' to 78°17' E (Singh et al., 2023), as shown

in Figure 1.

Rajasthan is renowned for its agriculture, with the sector's Gross State Domestic Product (GSDP) expanding at 8.66% based on constant (2011-2012) prices, more than double the national average of 4.6 %. Agriculture accounts for a quarter of the state's gross value added and employs 62 % of the workforce, making the sector central to the state's economic development (Government of Rajasthan, 2026a). However, a substantial part of Rajasthan's agriculture relies on rainfed systems, with only 42 % of the land equipped with irrigation. Groundwater, primarily wells and tube wells, supplies 72 % of the irrigation needs (Singh et al., 2023).

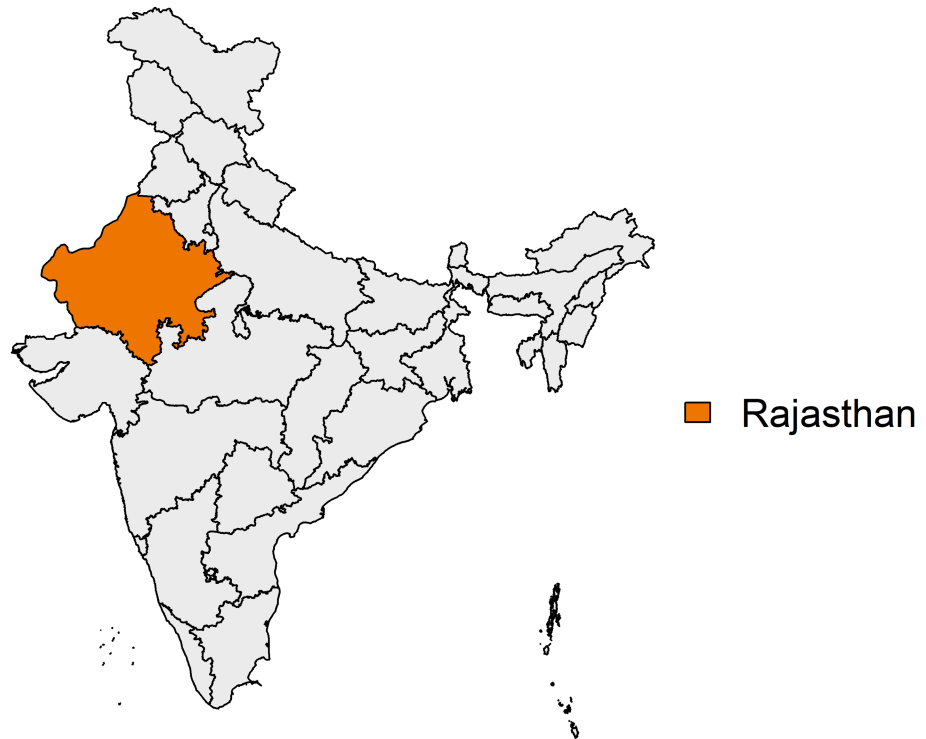


Figure 1: Location of Rajasthan in India.

The state's geography is unique because of the Thar Desert and the Aravalli mountain ranges. The Aravalli Range runs through the state, with 60 % in the northwest and 40 % in the southeast. Western Rajasthan differs significantly from Eastern Rajasthan in terms of physical environment, climate, socio-economic characteristics and agricultural systems. Western Rajasthan, which comprises the Thar Desert, is arid and receives low and highly erratic annual rainfall, experiences frequent droughts, high temperatures,

sandy soils, and limited surface water resources. In contrast, Eastern Rajasthan receives significantly higher rainfall, is more fertile with better groundwater availability, has higher irrigation coverage and supports more diversified and productive agriculture. Due to these favourable conditions, Eastern Rajasthan is densely populated, has better infrastructure, is more urbanised, has a stronger industrial and service sector and overall is more prosperous than Western Rajasthan (Government of Rajasthan, 2026a,b).

The Rajasthan’s agricultural sector is highly exposed to recurrent droughts, erratic monsoons, heatwaves, water scarcity and increasing climate variability (Mundetia & Sharma, 2015; Singh & Kumar, 2016; Patel et al., 2024). These factors make the agriculture sector highly risky and increase the importance of crop insurance as a mechanism for stabilising farmers’ income. Owing to these characteristics, Rajasthan was among the states who adopted PMFBY since its inception in 2016. It has consistently accounted for a significant share of the insured area (22 %), the number of farmers insured (15 %), and the sum insured (19 %) under PMFBY (Table 5), second only to Maharashtra. Nevertheless, considerable disparities exist across districts, reflecting differences in climatic vulnerability, cropping systems, awareness levels, institutional outreach, and programme implementation (Tanwar et al., 2019; John and Philip, 2025).

The literature on PMFBY’s performance in Rajasthan remains relatively limited. Existing studies indicate that the scheme has contributed to increased insurance coverage, enrolment, and financial protection for farmers (NABARD, 2021; Gupta et al., 2025; Natwadia et al., 2025). However, many findings highlight issues such as administrative inefficiencies, delays in claim settlement, low awareness and poor understanding of the PMFBY provisions, limited transparency and trust issues, and a weak system for extension and communication (Dhayal et al., 2018; Shrimali et al., 2023; Nikita & Sharma, 2024; Natwadia et al., 2025; Rathore, 2026). Much of the existing evidence is district-specific (example Churu, Jaipur, Jodhpur, Sikar, Barmer) and does not reveal broader statewide trends. Additionally, most studies mainly rely on cross-sectional data rather than district-level panel data, and there is limited comparison between Western and Eastern Rajasthan, despite their differing agro-climatic conditions. There is limited empirical evidence on how PMFBY participation evolved following the 2020 transition to voluntary enrolment for loanee farmers particularly at the district level in Rajasthan.

An important strand of the crop-insurance literature suggests that farmers' current insurance decisions may be influenced by their previous experience with insurance. In particular the receipt of an insurance payout can affect subsequent demand by providing farmers with information about the functioning and potential value of insurance. [Stein \(2018\)](#), using evidence from a commercial rainfall-index insurance product in India finds that farmers who received an insurance payout were 9–22 percentage points more likely to purchase insurance in the subsequent year. This finding provides direct evidence that realized insurance experience can influence subsequent insurance demand.

Evidence from experimental settings also supports the importance of previous insurance experience. [Cole et al. \(2014\)](#), using a seven-year panel from a rainfall-index insurance experiment show that recent insurance experience affects subsequent demand. They further demonstrate that the payout experiences of other farmers within the same village can influence an individual's subsequent insurance purchase thus indicating that insurance-related learning and experience can extend beyond one's own direct experience. Similarly [Karlan et al. \(2014\)](#) find that subsequent demand for rainfall-index insurance increases with farmers' own receipt of insurance payouts, payouts received by members of their social networks and recent adverse rainfall experiences.

Evidence from India also indicates that crop-insurance adoption remains relatively limited despite substantial public support. [Aditya et al. \(2018\)](#) using a large-scale farmer survey report low crop-insurance adoption in both Kharif and Rabi seasons and identify awareness, previous crop losses, agricultural training and premium subsidies among factors associated with insurance adoption. More recently, [Biswal and Bahinipati \(2025\)](#) using nationally representative agricultural household survey data together with PMFBY information, find that crop-insurance adoption in India remains limited and varies substantially across states and socioeconomic groups. Their findings also highlight institutional capacity and basis risk as important issues for expanding insurance adoption.

Evidence specifically relating to PMFBY also points to persistent implementation and participation challenges. [Kaur et al. \(2021\)](#) report relatively low PMFBY coverage in terms of farmers insured, area insured, claims paid and farmers benefited during the early years of the scheme. Their analysis further finds a significant relationship between farmers' premium and the number of farmers insured while identifying claim-settlement

delays, scheme complexity and lack of awareness as important weaknesses. Similarly, [Punia et al. \(2021\)](#) based on a survey of farmers in six Haryana districts, document delays in claim settlement, inaccurate yield estimation, inadequate implementation and lack of awareness as important constraints. Their findings also indicate that non-loanee farmers reported concerns relating to claim assessment and lack of faith in the insurance system.

The existing literature therefore provides evidence that insurance participation is influenced by socioeconomic and institutional factors and that previous insurance experience can shape subsequent demand. This perspective is particularly relevant to the present study because the district-level panel results show a positive and statistically significant association between lagged farmers benefited and subsequent insurance participation. The finding is consistent with the broader evidence that realized insurance experience can shape subsequent insurance demand ([Cole et al., 2014](#); [Karlan et al., 2014](#); [Stein, 2018](#)). However the present study uses aggregate district-level data, the estimated relationship should be interpreted as an association rather than as evidence of a causal effect of receiving insurance benefits.

The present study relates to this literature but differs in its unit of analysis and institutional setting. Rather than observing individual purchase decisions, the present study uses district-level administrative data on PMFBY participation in Rajasthan. It examines whether the number of farmers benefiting from the scheme in one period is associated with subsequent district-level enrollment. The analysis therefore provides evidence on the persistence of district-level participation associated with previous scheme experience while recognising that the aggregate data do not permit identification of individual learning, peer effects, or other behavioural mechanisms separately.

The study primarily contributes to the literature in three ways. First, it provides a district-level panel assessment of PMFBY in Rajasthan over 2018–19 to 2025–26 incorporating temporal, seasonal and spatial dimensions of scheme performance. Second, it examines whether previous-period scheme experience is associated with subsequent enrollment, separately considering total, loanee and non-loanee participation. Third, it examines changes in participation following the 2020 transition to voluntary enrollment and investigates whether these patterns differ between Western and Eastern Rajasthan.

The analysis therefore combines administrative evidence on scheme participation with a regional perspective on the evolution of crop insurance in the state.

2. Data and Methodology

This study relies exclusively on secondary data from official sources, such as the PMFBY portal, the Ministry of Agriculture and Farmers' Welfare, the Government of Rajasthan Environmental portal and other published reports. Covering the period from 2018-19 to 2025-26, it allows for an evaluation of PMFBY's performance before and after the 2020 voluntary participation reform. The dataset is a district-level balanced panel providing information on the socio-economic aspects of the farmers, assembled separately for the Kharif and Rabi seasons to analyse districts across Rajasthan from 2018-19 to 2025-26. The dataset contains information pertaining to the farmers' enrolment, premiums, claims, social background, landholding details and beneficiaries.

Descriptive statistical techniques are used to evaluate Rajasthan's performance relative to the national context and to assess seasonal performance during Kharif and Rabi seasons. The districts are compared using their mean values over time; across various factors: the number of farmers insured, total loanee farmer applications, total non-loanee farmer applications, total sum insured, total area insured, percentage area coverage, total gross premium paid, total claim paid, and total number of farmers benefited. The specification that we used for our analysis is as follows

$$Y_{it}^s = \alpha + \beta_1 Claimpaid_{i,t-1}^s + \beta_2 FarmerBenefit_{i,t-1}^s + \beta_3 FarmerPremium_{i,t-1}^s + X_{it}'\theta + \mu_i + \lambda_t + \phi_s + \varepsilon_{it} \quad (1)$$

Y_{it}^s denotes the outcome variable for district i in year t for season s ($s = \text{Kharif or Rabi}$). It is alternately measured as total farmers insured, total loanee farmer applications, or total non-loanee farmer applications in season s .

$Claimpaid_{i,t-1}^s$, $FarmerBenefit_{i,t-1}^s$ and $FarmerPremium_{i,t-1}^s$ denote the total claims paid, the number of farmers benefited and the total premium paid during the previous cropping season.

X_{it} is a vector of control variables which includes social groups and landholding details.

μ_i represents district fixed effects, λ_t represents time fixed effects, ϕ_s represents season fixed effects, and ε_{it} is the idiosyncratic error term.

The specification is run for the entire data set which includes district-wise data for both cropping seasons as well as separately for Kharif and Rabi seasons for higher granularity. The use of one-period lags is intended to examine whether previous period scheme outcomes are associated with subsequent participation. The coefficients should therefore be interpreted as conditional associations rather than causal effects. In particular, a lagged claim or beneficiary measure does not necessarily imply that the corresponding payout had been received or observed by farmers before the subsequent enrollment decision. Claim settlement may occur after the enrollment period for the following season. The specifications with two period lags as a robustness check showed no substantial qualitative difference from our main specification. However, the analysis cannot directly identify with certainty the behavioural mechanism through which previous scheme experience may affect subsequent participation and is a limitation of our experimental design.

Furthermore, a distinction has been created for western and eastern districts of Rajasthan owing to their differential agroclimatic conditions. Since 2023, Rajasthan has officially 41 districts for administrative purposes but PMFBY data is reported according to the original 33 districts. For the purpose of the study, the 11 Western Districts are : “Barmer”, “Bikaner”, “Churu”, “Hanumangarh”, “Jaisalmer”, “Jalore”, “Jodhpur”, “Nagaur”, “Pali”, “Sri Ganganagar” and “Sirohi” (highlighted in blue) and the remaining 22 districts are grouped as Eastern Districts.(Figure 2).

In order to disentangle the differential impact on the two set of districts, we run the following regression:

$$\begin{aligned}
Y_{it}^s = & \alpha + \beta_1 Claimpaid_{i,t-1}^s + \beta_2 FarmerBenefit_{i,t-1}^s + \beta_3 FarmerPremium_{i,t-1}^s \\
& + \beta_4 west_{it}^s + \beta_5 Claimpaid_{i,t-1}^s \times west_{it}^s \\
& + \beta_6 FarmerBenefit_{i,t-1}^s \times west_{it}^s + \beta_7 FarmerPremium_{i,t-1}^s \times west_{it}^s \\
& + X'_{it}\theta + \mu_i + \lambda_t + \phi_s + \varepsilon_{it}
\end{aligned} \tag{2}$$

$west_{i,t}^s$ is the dummy variable which takes the value 1 for western districts.

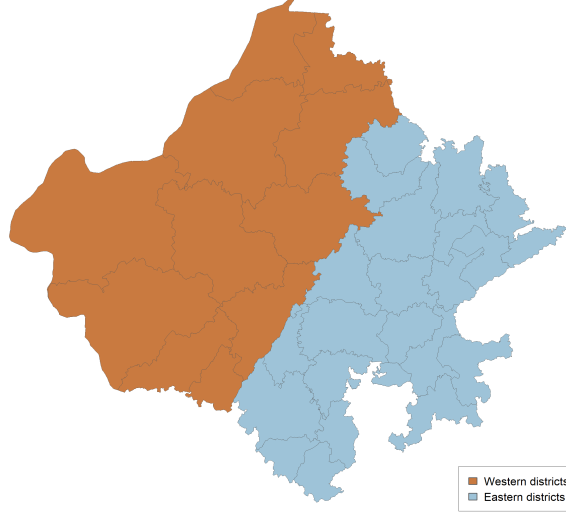


Figure 2: Rajasthan- Western and Eastern Districts

PMFBY enrolment was mandatory for loanee farmers until Kharif 2020, when it became voluntary for all farmers. We use this institutional change as the reference point for examining the evolution of enrolment before and after 2020. The panel begins in 2018–19 and the main regression specification uses one-period lagged scheme outcomes, thus the post-2020 trend analysis is presented relative to 2019 as the pre-reform reference period.

$$Y_{it}^s = \alpha + \sum_{k \neq -1} \sigma_k \mathbf{1}(Year_{it} = k) + \beta_1 Claimpaid_{i,t-1}^s + \beta_2 FarmerBenefit_{i,t-1}^s + \beta_3 FarmerPremium_{i,t-1}^s + X'_{it}\theta + \mu_i + \phi_s + \varepsilon_{it} \quad (3)$$

With outcome variables, lagged independent variables, social or landholding controls and district or season fixed effects, the same as the above specification.

Here the year coefficients describe changes in the outcome relative to the 2019 reference year. Because the reform was implemented broadly across the PMFBY population and only one pre-reform reference period is available after accounting for the lagged specification, these coefficients are interpreted as post-2020 changes rather than as causal treatment effects.

To analyse regional differences, we interact year indicators with a dummy variable for Western Rajasthan (West), using Eastern Rajasthan as the baseline. The interaction

coefficients reflect the differential change in PMFBY participation in Western Rajasthan relative to Eastern Rajasthan, compared with the 2019 West-East difference. The trend analysis is presented graphically with confidence intervals, and they help evaluate the timing, size, and persistence of changes following 2020. The interpretation focuses on evidence of dynamic changes and regional variations over causal treatment effects.

3. Results

3.1 Descriptive Evidence

3.1.1 Rajasthan in the National Context: Performance of PMFBY

In this section, we compare PMFBY performance in Rajasthan with the national average and evaluate the extent to which the scheme has benefited the state compared to the rest of the country. The comparison focuses on key indicators such as Area penetration (total insured area divided by gross cropped area), Claim ratio (total claim paid divided by gross premium collected), farmer-benefited ratio (total farmers benefited divided by total farmers insured) and the proportion of non-loanee applications in total applications, reflecting the scheme’s popularity among non-loanee farmers.

Area Penetration

Between 2018-19 and 2023-24, the insured area increased from 77.1 lakh hectares to over 103.1 lakh hectares, peaking at 113.3 lakh hectares in Rajasthan in 2020- 21. The percentage of gross cropped area insured in Rajasthan increased from 30.45% in 2018–19 to a peak of 43.42 % in 2020–21, then stabilised at around 37–39 % in the subsequent year ([Table 1](#)). The gradual decline after 2020-21 may be due to policy reforms that made crop insurance voluntary for all farmers from kharif 2020; improved rainfall in recent years; or withdrawal of some farmers due to concerns about claim settlement. However, Rajasthan still insured over a third of its cropped area, reflecting strong institutional support. In contrast, area insured at national level declined from 23.09 % in 2018–19 to 18.12% in 2021–22, then rose modestly to 22.88% in 2023–24. Rajasthan maintained area coverage above 37% throughout, ranging from 7 to 24 percentage points above the national average. This indicates greater institutional adoption of PMFBY, broader

coverage of cultivated land and stronger state implementation of crop insurance as an important risk management strategy.

Table 1: Area Penetration under PMFBY

Year	Rajasthan			India		
	Total Area Insured	Gross Cropped Area	% Area Insured under PMFBY	Total Area Insured	Gross Cropped Area	% Area Insured under PMFBY
2018–19	7,708.32	25,313.35	30.45	46,447.76	201,179	23.09
2019–20	9,775.09	27,515.43	35.53	43,665.37	211,359	20.66
2020–21	11,332.99	26,099.97	43.42	42,482.26	216,107	19.66
2021–22	10,694.83	27,441.85	38.97	39,721.10	219,158	18.12
2022–23	10,590.94	28,171.11	37.60	41,430.00	219,357	18.89
2023–24	10,315.88	27,695.97	37.25	49,844.35	217,882	22.88

Note: Area is measured in thousand hectares.

Source: Ministry of Agriculture and Farmers' Welfare; Agricultural Statistics (Rajasthan); Land Use Statistics at a Glance (2023–24).

Farmer Benefited Ratio

Rajasthan consistently shows a higher ratio of farmers benefiting from insurance during the Kharif season than the national average. The benefit ratio surpasses the national figure nearly every year, reaching 58.39% in 2021-22, whereas India's was 49.92 %. This suggests a greater share of insured farmers in Rajasthan received claims. Even in years of lower performance, such as 2024-25, Rajasthan's ratio (22.54%) was still close to the national level(27.08%) (Table 2). In contrast, the Rabi season shows weaker performance, with Rajasthan's farmers benefiting ratio mostly below the national average, especially in 2018-19 (19.8 % vs. 31.07 %) and 2021-22(16.39% vs. 29.23 %), with the exception of 2022-23 (Table 3).

Claim Ratio

The claim ratio highlights Rajasthan's increased vulnerability to climatic and production risks. During the Kharif season, Rajasthan's claim ratio exceeded 100% in 2018-19(110.99 %), 2021-22 (109.16 %), and 2023-24 (105.49%), while the national averages were considerably lower at 89.09%, 75.54%, and 68.05%, respectively (Table 2). These figures indicate claim payments surpassed premiums, pointing to significant crop losses. In Rabi, Rajasthan's claim ratio reached 102.43% in 2022-23, almost double the national

rate of 53.35% (Table 3) A key aspect is Rajasthan’s greater annual variations in claim ratio compared to India-level aggregates. This suggests that Rajasthan’s agriculture faces greater exposure to droughts, unpredictable rainfall, and other weather-related shocks.

Non-Loanee Farmer participation

An important observation is low engagement of non-loanee farmers in Rajasthan. During both Kharif and Rabi seasons, their share in Rajasthan’s pool of insured farmers consistently stayed below 8%, while the national average ranged from 17% to over 43% (Table 2 and Table 3). Despite a gradual increase, voluntary non-loanee enrolments remain very low compared to the country as a whole. Notably, the Rajasthan PMFBY scheme continues to rely on loaned farmers, indicating a strong institutional credit link of the policy and probably reliance on other risk management methods.

Table 2: Comparative Performance of PMFBY during Kharif Seasons in Rajasthan and India

Year	Farmer Benefited Ratio		Claim Ratio		Non-loanee Applications (%)	
	Rajasthan	India	Rajasthan	India	Rajasthan	India
2018–19	45.77	32.25	111.00	89.09	0.13	38.63
2019–20	50.66	46.24	96.88	110.03	1.31	43.16
2020–21	38.33	34.75	65.13	72.27	2.07	35.18
2021–22	58.39	49.92	109.16	75.54	4.35	24.95
2022–23	39.11	36.92	49.98	57.58	5.45	33.17
2023–24	42.49	39.10	105.49	68.05	5.72	39.50
2024–25	22.54	27.08	43.63	45.85	6.87	36.50
2025–26	33.61	16.64	75.81	47.80	7.54	22.97

Note: Farmer Benefited Ratio represents the percentage of insured farmers who received claim benefits. Claim Ratio is the ratio of claims paid to premium collected, expressed as a percentage. Non-loanee Applications (%) represents the percentage of PMFBY applications submitted by non-loanee farmers.

Source: Author’s estimates based on data from the Ministry of Agriculture and Farmers’ Welfare.

Table 3: Comparative Performance of PMFBY during Rabi Seasons in Rajasthan and India

Year	Farmer Benefited Ratio		Claim Ratio		Non-loanee Applications (%)	
	Rajasthan	India	Rajasthan	India	Rajasthan	India
2018–19	19.80	31.07	56.94	103.66	0.05	42.79
2019–20	22.96	21.26	94.14	69.49	0.83	28.68
2020–21	20.96	27.88	61.78	55.00	0.47	37.97
2021–22	16.39	29.23	44.21	44.05	4.89	26.13
2022–23	35.26	24.30	102.43	53.35	2.91	19.72
2023–24	24.89	19.68	65.76	47.56	5.48	35.30
2024–25	11.07	12.32	50.96	40.03	6.27	25.84
2025–26					5.06	16.71

Note: Farmer Benefited Ratio represents the percentage of insured farmers who received claim benefits. Claim Ratio is the ratio of claims paid to premium collected, expressed as a percentage. Non-loanee Applications (%) represents the percentage of PMFBY applications submitted by non-loanee farmers. Blank cells indicate that data were not available.

Source: Author’s estimates based on data from the Ministry of Agriculture and Farmers’ Welfare.

3.1.2 Inter-State Comparison of PMFBY performance

Table 4 and Table 5 show the coverage of PMFBY in terms of farmers covered, area insured and sum insured across states during 2018-19 and 2024-25. There have been significant changes in the geographical distribution of PMFBY across India. The implementation has become increasingly concentrated in a few states. This reflects differences in agricultural area, cropping patterns, state-level implementation, and farmer participation.

In 2018-19, Madhya Pradesh led with the highest insured area (27.81%) and sum insured (23.8%), and 14.71% of insured farmers under PMFBY. Maharashtra was second, with 18.41% of insured farmers, 18.36% of insured area, and 13.51% of the total sum insured. Rajasthan contributed 9.89% of insured farmers, 16.60 % of insured area, and 14.58 % of the sum insured, ranking it among the third or fourth best-performing state.

By 2024-25, Maharashtra emerged as the top state in PMFBY, with 29.23 % of insured farmers, 31.02 % of insured area, and 27.19 % of the total sum insured. Rajasthan improved its standing, becoming the second-largest contributor, with the share of insured farmers rising from 9.89% to 14.97% , insured area from 16.60% to 21.91%, and sum insured from 14.58% to 19.42%.

Table 4: State/UT-wise Coverage of PMFBY, 2018–19

S. No.	State/UT	Farmer's Coverage of PMFBY (%)	Area Coverage of PMFBY (%)	Sum Insured Coverage of PMFBY (%)
1	Andhra Pradesh	3.46	2.72	4.13
2	Assam	0.19	0.11	0.16
3	Chhattisgarh	3.63	4.87	4.07
4	Goa	0.0009	0.0006	0.0016
5	Gujarat	0.0005	0.0006	0.0006
6	Haryana	3.50	4.43	6.96
7	Himachal Pradesh	0.45	0.14	0.10
8	Jammu and Kashmir	0.40	0.24	0.48
9	Jharkhand	2.75	1.36	1.77
10	Karnataka	7.15	0.0064	0.00006
11	Kerala	0.04	0.03	0.07
12	Madhya Pradesh	14.71	27.81	23.81
13	Maharashtra	18.41	18.36	13.51
14	Odisha	4.95	3.22	4.46
15	Puducherry	0.0003	0.0003	0.0004
16	Rajasthan	9.89	16.60	14.58
17	Sikkim	3.08	2.96	4.28
18	Tamil Nadu	0.87	0.77	1.25
19	Telangana	1.20	0.99	1.82
20	Uttar Pradesh	14.45	11.08	11.09
21	Uttarakhand	0.35	0.18	0.31
22	West Bengal	10.53	4.13	7.17
Grand Total		100.00	100.00	100.00

Notes: Farmer's coverage is the percentage share of farmers insured under PMFBY in a particular state/UT relative to the total number of farmers insured under PMFBY across India. Area coverage is the percentage share of the area insured under PMFBY in a particular state/UT relative to the total area insured under PMFBY across India. Sum insured coverage is the percentage share of the sum insured under PMFBY in a particular state/UT relative to the total sum insured under PMFBY across India.

Source: Ministry of Agriculture and Farmers' Welfare.

Over the years, Madhya Pradesh and Uttar Pradesh witnessed a decline in PMFBY coverage. Moderate improvements were observed in Andhra Pradesh, Jharkhand, and Odisha, while smaller states and Union Territories continued to represent only a small share of the PMFBY portfolio.

Table 5: State/UT-wise Coverage of PMFBY, 2024–25

S. No.	State/UT	Farmer's Coverage of PMFBY (%)	Area Coverage of PMFBY (%)	Sum Insured Coverage of PMFBY (%)
1	Andaman & Nicobar Islands	0.0005	0.0003	0.0004
2	Andhra Pradesh	7.59	5.18	9.13
3	Assam	2.52	1.47	2.50
4	Chhattisgarh	4.80	5.02	4.48
5	Goa	0.0003	0.00002	0.00004
6	Haryana	2.05	2.31	3.68
7	Himachal Pradesh	0.56	0.14	0.16
8	Jammu and Kashmir	0.56	0.17	0.23
9	Jharkhand	6.26	2.86	3.78
10	Madhya Pradesh	12.53	18.58	14.50
11	Maharashtra	29.23	31.02	27.19
12	Meghalaya	0.12	0.04	0.06
13	Odisha	6.82	3.50	5.21
14	Puducherry	0.04	0.03	0.04
15	Rajasthan	14.97	21.91	19.42
16	Sikkim	0.0019	0.0005	0.0017
17	Tamil Nadu	2.94	3.00	3.69
18	Tripura	0.06	0.0055	0.0091
19	Uttar Pradesh	8.77	4.71	5.85
20	Uttarakhand	0.17	0.04	0.05
Grand Total		100.00	100.00	100.00

Notes: Farmer's coverage is the percentage share of farmers insured under PMFBY in a particular state/UT relative to the total number of farmers insured under PMFBY across India. Area coverage is the percentage share of the area insured under PMFBY in a particular state/UT relative to the total area insured under PMFBY across India. Sum insured coverage is the percentage share of the sum insured under PMFBY in a particular state/UT relative to the total sum insured under PMFBY across India.

Source: Ministry of Agriculture and Farmers' Welfare.

3.1.3 Comparative analysis of PMFBY in Rajasthan: Kharif vs. Rabi

The implementation and performance of PMFBY in Rajasthan show significant seasonal variations. Over the years, the Kharif season has consistently surpassed the Rabi season in terms of farmer participation, beneficiaries, premium collections, and claim payouts. This highlights the crucial role of monsoons in Rajasthan's rain-fed agricultural system, where production risks are substantially higher.

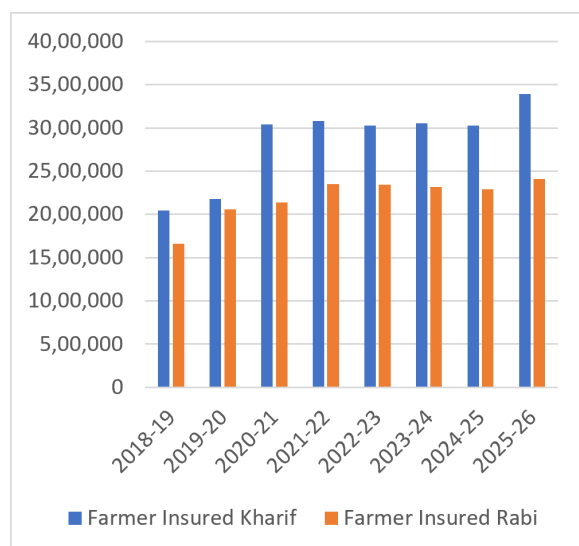
During the study period, the number of insured farmers remained higher in the Kharif season. Kharif insured farmers grew from about 20.5 lakh in 2018-19 to over 33 lakh in 2025-26, while Rabi insured farmers increased more gradually from nearly 16.6 lakh to around 24 lakh (Figure 3a). Both seasons saw gradual growth in insurance coverage,

but Kharif consistently insured nearly one-third more farmers than Rabi, indicating a stronger farmer reliance on insurance during the monsoon season.

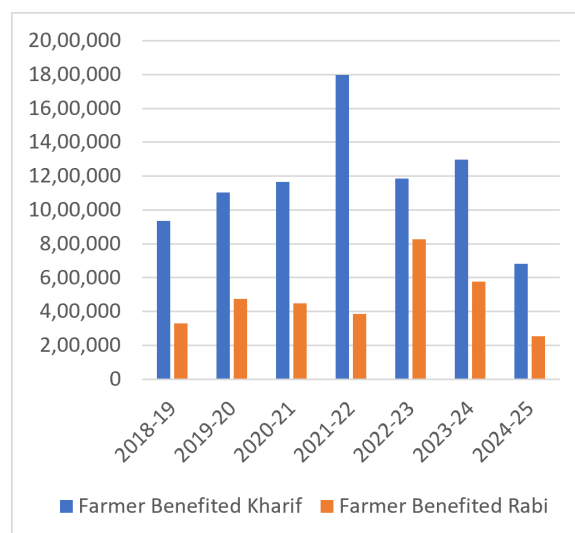
A similar pattern appears in the beneficiary farmer counts. Kharif beneficiaries ranged from roughly 9 lakh to nearly 18 lakh farmers, peaking in 2021-22. Meanwhile, Rabi beneficiaries stayed significantly lower, between about 3 lakh and 8.25 lakh (Figure 3b). A higher beneficiary number again indicates that the kharif season is riskier than the Rabi season.

The pattern of applications under PMFBY in Rajasthan illustrates a notable shift after 2020 reforms, which made the scheme voluntary for all farmers (loanee and non-loanee). Before 2020-21, most enrolments were by loanee farmers with minimal participation from non-loanee farmers in both Kharif and Rabi seasons. From 2020-21, applications from both loanee and non-loanee farmers increased significantly, with the Kharif season consistently surpassing the Rabi season in application numbers (Figure 4). This suggests that farmers regard crop insurance as a vital risk mitigation measure and voluntarily opt for it, highlighting its popularity.

Figure 5 and Table 6 illustrate clear seasonal differences in the premium structure under PMFBY in Rajasthan. Across the years, gross premiums exceeded during the Kharif season compared to the Rabi season, due to high actuarial cost of insuring Kharif farmers. Conversely, farmers' premium collections are generally higher during Rabi, especially after 2020-21. This trend results from the larger sum insured in Rabi, which increased the total farmer premium despite a lower premium rate. As shown in Table 6, the farmer premium to sum insured ratio was around 2.1-2.3 % in Kharif and 1.8-2 % in Rabi, indicating farmers didn't carry a heavier premium burden in Rabi. Instead, the higher premium collection was driven by the greater insured crop value. The overall premium to sum insured ratio was consistently higher in Kharif (12.3-29.3%) than Rabi (7.2-11.2%), reflecting greater actuarial risk during the monsoon season. As a result, government subsidies made up 83.2-89.3% of total premium in Kharif, compared to 73.6-83.1% in Rabi. Although farmers paid more in premium during Rabi, the government financial support remained larger during Kharif due to higher insurance risks. The higher claim payments during Kharif season further indicate the greater incidence of crop losses, which contributed to higher actuarial premiums and consequently larger



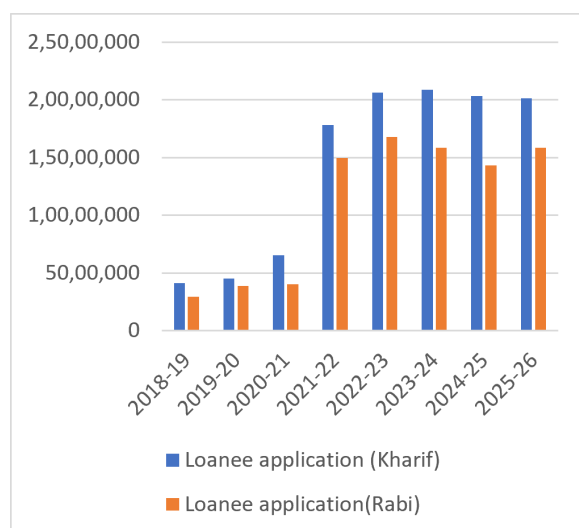
(a) Trend in number of farmers insured under PMFBY in Rajasthan



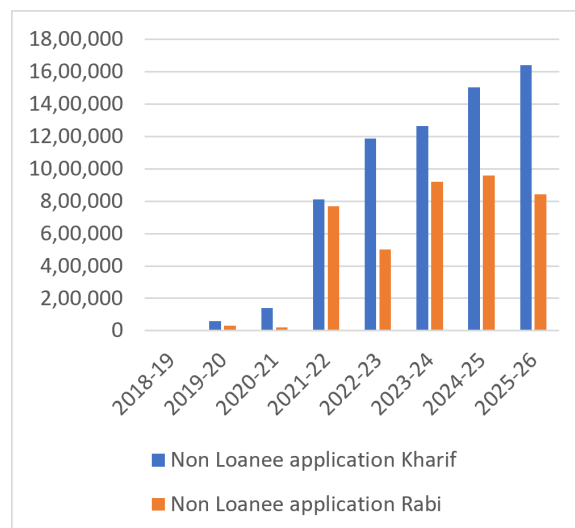
(b) Trend in number of farmers benefited under PMFBY in Rajasthan

Figure 3: Trends in farmer participation and benefits under PMFBY in Rajasthan

Source: Ministry of Agriculture and Farmers' Welfare.



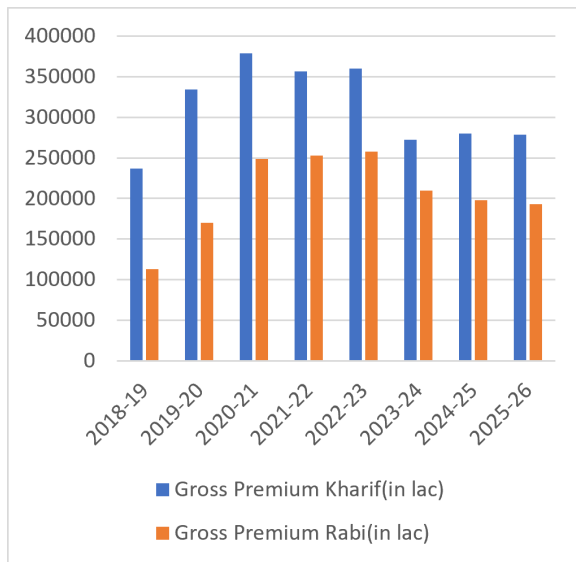
(a) Trend in number of loanee applications under PMFBY in Rajasthan



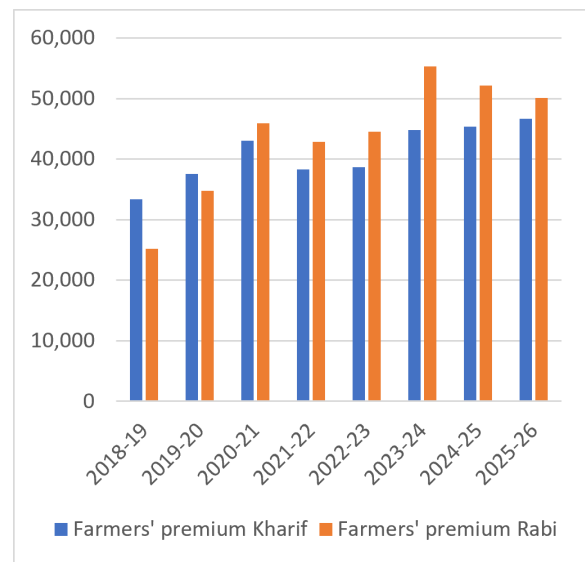
(b) Trend in number of non-loanee applications under PMFBY in Rajasthan

Figure 4: Trends in loanee and non-loanee applications under PMFBY in Rajasthan

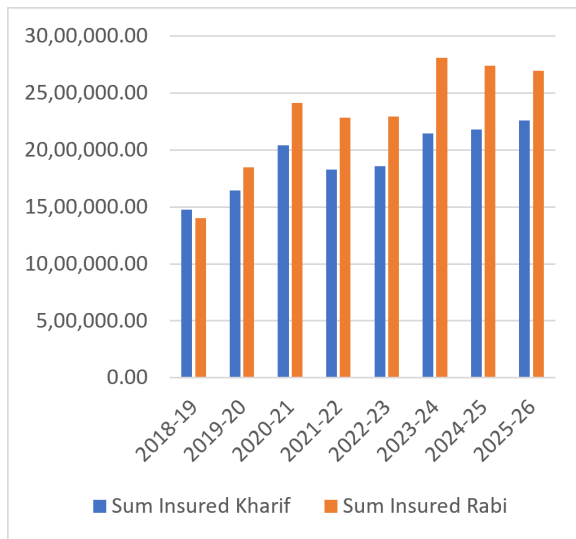
Source: Ministry of Agriculture and Farmers' Welfare.



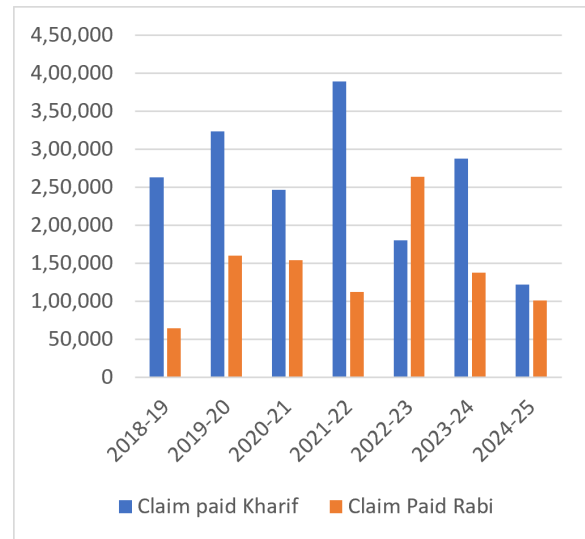
(a) Trend in Gross Premium under PMFBY in Rajasthan



(b) Trend in Farmers' Premium under PMFBY in Rajasthan



(c) Trend in Total Sum Insured under PMFBY in Rajasthan



(d) Trend in Total Claim Paid under PMFBY in Rajasthan

Figure 5: Trends in Premium, Sum Insured and Claims under PMFBY in Rajasthan

Source: Ministry of Agriculture and Farmers' Welfare.

Table 6: Premium Structure and Government Subsidy under PMFBY in Rajasthan: Kharif and Rabi

Year	Kharif			Rabi		
	Farmer Premium Rate	Total Premium Rate	Government Subsidy Share	Farmer Premium Rate	Total Premium Rate	Government Subsidy Share
2018–19	0.023	0.160	0.859	0.018	0.081	0.777
2019–20	0.023	0.203	0.888	0.019	0.092	0.796
2020–21	0.021	0.185	0.886	0.019	0.103	0.816
2021–22	0.021	0.195	0.893	0.019	0.111	0.831
2022–23	0.021	0.194	0.893	0.019	0.112	0.827
2023–24	0.021	0.127	0.836	0.020	0.075	0.736
2024–25	0.021	0.129	0.838	0.019	0.072	0.737
2025–26	0.021	0.123	0.832	0.019	0.072	0.740

Notes: Farmer Premium Rate is measured as farmer premium relative to the sum insured. Total Premium Rate is measured as total premium relative to the sum insured. Government Subsidy Share is measured as government subsidy relative to total premium.

Source: Ministry of Agriculture and Farmers' Welfare.

Overall, the findings show that PMFBY displays clear seasonal variations in Rajasthan. During the Kharif season, farmer participation increases, beneficiary farmers rise, claim payments increase, and government support increases because of increased production risk. In contrast, Rabi sees higher total insured amounts and more farmer premium collections. These results highlight that the scheme's performance is influenced by the interplay between production risk, insured values, and subsidy mechanisms across the two cropping seasons.

3.1.4 District-wise Performance of PMFBY in Rajasthan: A Spatial Analysis

The analysis of spatial distribution of PMFBY performance in Rajasthan is done by computing the district-wise mean values of key scheme indicators for both Kharif and Rabi seasons over the study period. Averaging across years minimises the influence of year -specific climatic shocks and offers a more reliable view of long-term performance and consistency at the district level.

Districts such as Hanumangarh, Churu, Nagaur, Jodhpur, Bikaner, Jhalawar and Sri Ganganagar persistently showed higher farmer enrolment in both seasons. Conversely,

districts like Dholpur, Karauli, Rajsamand, Dungarpur, Sirohi, and Dausa had lower insured farmers, suggesting limited participation (Figure 6).

The distribution of loanee applications across districts shows a significant concentration. Hanumangarh consistently led in both seasons, with Sri Ganganagar, Barmer, Jaipur, Bharatpur, Churu, and Bikaner following. Again, districts like Dholpur, Karauli, Rajsamand, Sirohi, and Dausa had notably fewer applications during the entire study period (Figure 7).

The above gap is even wider for non-loanee applications. Hanumangarh showed remarkably high voluntary participation in both crop seasons, far surpassing all other districts. It was followed by Sri Ganganagar, Bikaner, Nagaur, Churu, Jodhpur, Jaipur and Jalore, while most districts had very low non-loanee enrolments. Districts such as Dholpur, Karauli, Rajsamand, Sirohi, Kota and Alwar consistently ranked at the bottom (Figure 8).

The analysis of farmer premium shows a similar pattern of ranking. Bikaner had the highest farmer premium during Kharif, while Jalore topped during Rabi. Districts such as Hanumangarh, Jodhpur, Churu, Nagaur, Barmer, and Sri Ganganagar consistently ranked among the top contributors in both seasons. Conversely, districts like Dholpur, Karauli, Rajsamand, Dungarpur, Udaipur, and Sirohi recorded the lowest premium (Figure 9).

Similarly, claim settlement patterns were comparable. Hanumangarh had the highest average claim settlement in Kharif, with Churu leading in Rabi. Districts including Jodhpur, Barmer, Bikaner, Sri Ganganagar, Jalore, and Jaisalmer also regularly reported higher claim settlements. Meanwhile, Dholpur, Rajsamand, Karauli, Dungarpur, Banswara, and Dausa persistently showed the lowest average claim settlements (Figure 10).

A similar trend is observed in the number of farmers benefiting from PMFBY. During Kharif, Barmer was the top district, while Churu had the most beneficiary farmers in Rabi. Districts like Hanumangarh, Jodhpur, Nagaur, Bikaner, Jhalawar, Jaipur, and Sri Ganganagar ranked high in both seasons. In contrast, districts such as Dholpur, Karauli, Rajsamand, Dausa, Dungarpur, Udaipur, and Sirohi has the lowest beneficiary coverage (Figure 11).

The spatial pattern of insured area and sum insured closely mirrors the trend of

farmers' enrolment. Districts like Barmer, Churu, Bikaner, Hanumangarh, Jodhpur, Nagaur, and Sri Ganganagar stand out, with Bikaner and Hanumangarh having the highest average sum insured during Kharif and Rabi seasons, respectively. On the other hand, Dholpur, Karauli, Rajsamand, Dungarpur, Sirohi, and Dausa regularly record the lowest insured areas and sum insured across seasons (Figure 12 and Figure 13).

The analysis of all the indicators together highlights significant spatial variation and clear patterns in the implementation and the outcomes of PMFBY across districts in Rajasthan. The rankings show a cluster of high-performing districts and a relatively stable group of low-performing districts. There is a clear west-east divide in PMFBY performance across Rajasthan. Western Districts (as defined in our study) generally outperform eastern districts in most indicators. Sirohi, despite being classified as a western district, shows lower performance. Eastern districts such as Dholpur, Karauli, Dungarpur, Dausa, and Banswara scored lower across indicators, whereas Jaipur, Jhalawar and Bhilwara performed above average on most indicators. Thus, the analysis highlights regional disparities and a distinctive west-east gap in PMFBY's implementation.

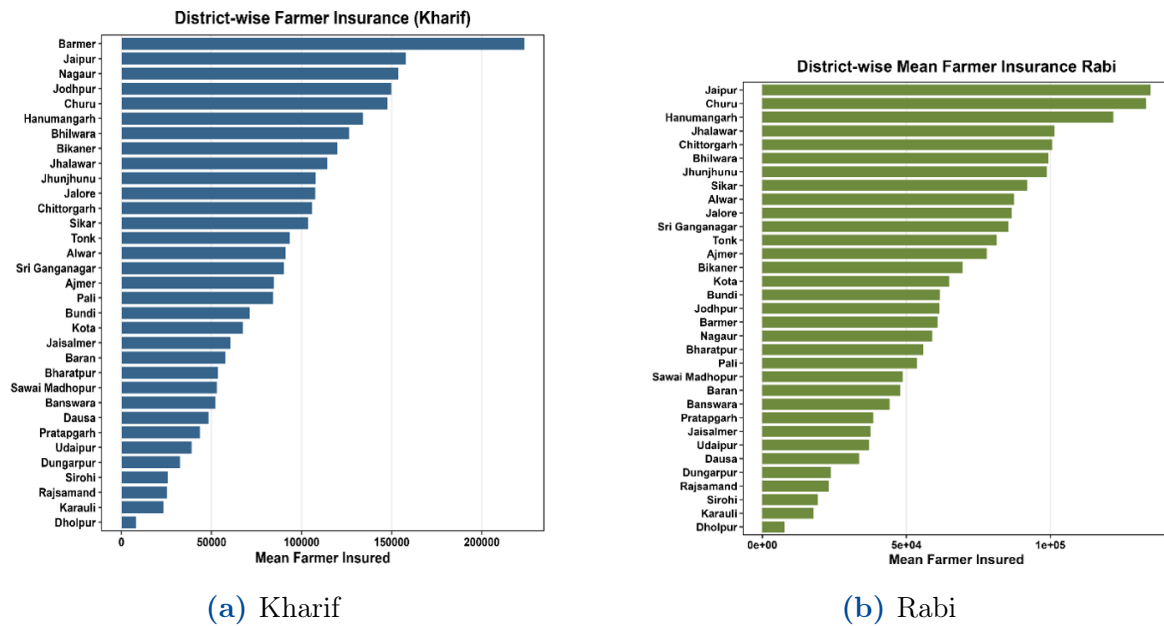
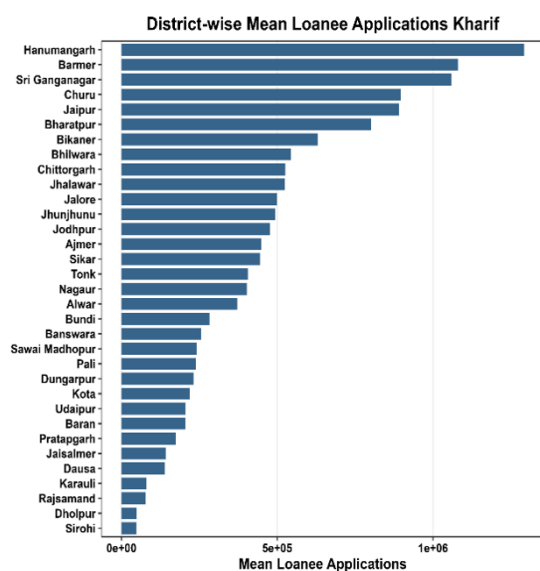
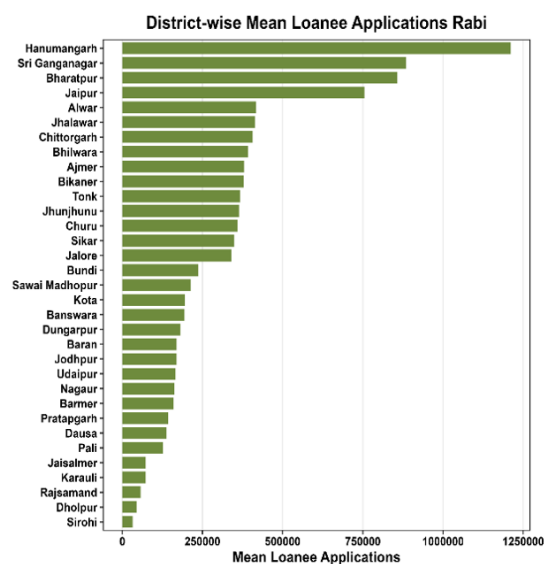


Figure 6: District-wise Mean Number of Farmers Insured under PMFBY: Kharif and Rabi, 2018–19 to 2025–26

Source: Ministry of Agriculture and Farmers' Welfare.



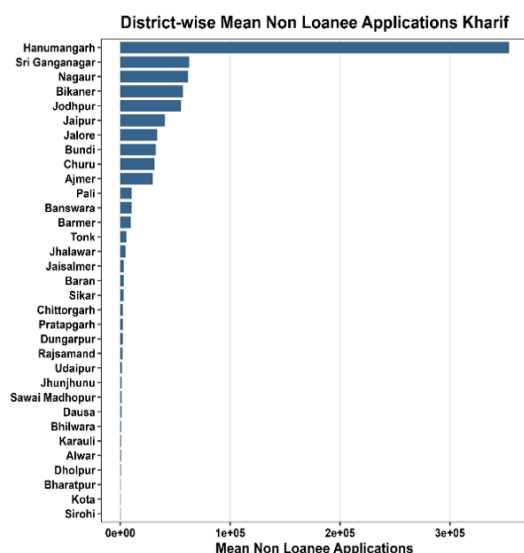
(a) Kharif



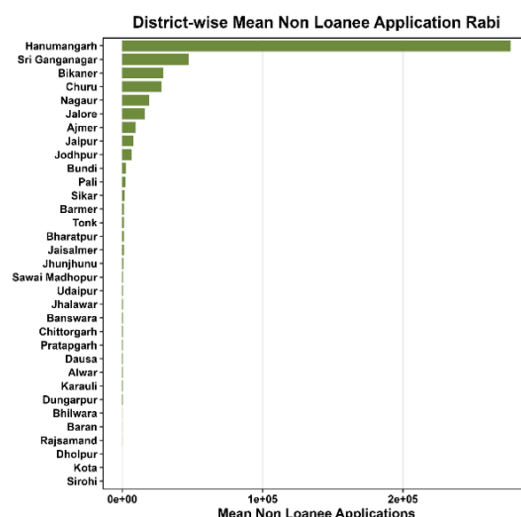
(b) Rabi

Figure 7: District-wise Mean Number of Loanee Applications under PMFBY: Kharif and Rabi, 2018–19 to 2025–26

Source: Ministry of Agriculture and Farmers' Welfare.



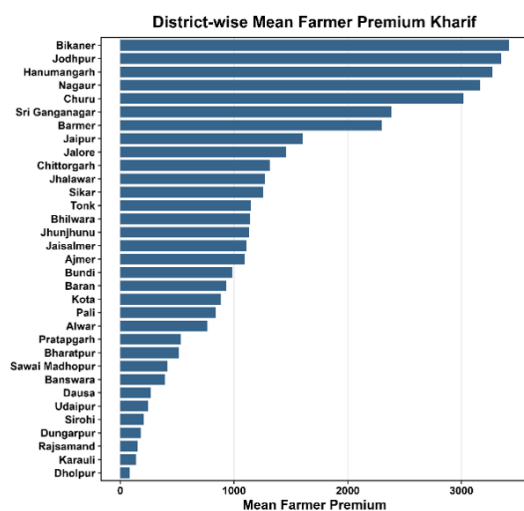
(a) Kharif



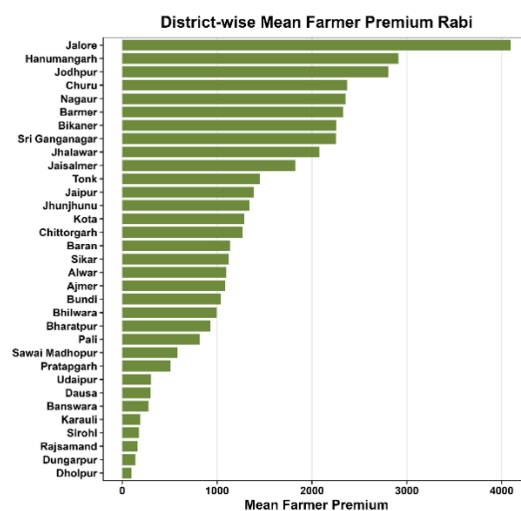
(b) Rabi

Figure 8: District-wise Mean Number of Non-Loanee Applications under PMFBY: Kharif and Rabi, 2018–19 to 2025–26

Source: Ministry of Agriculture and Farmers' Welfare.



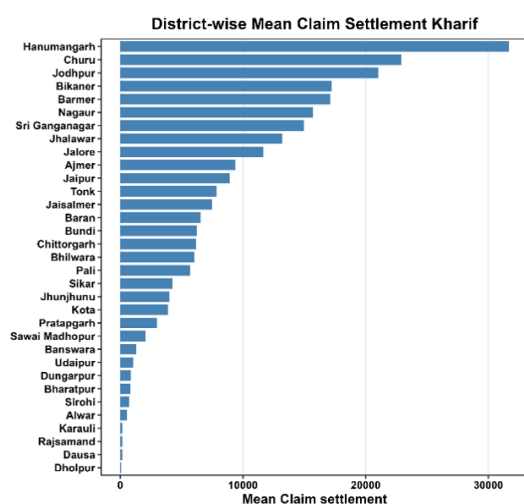
(a) Kharif



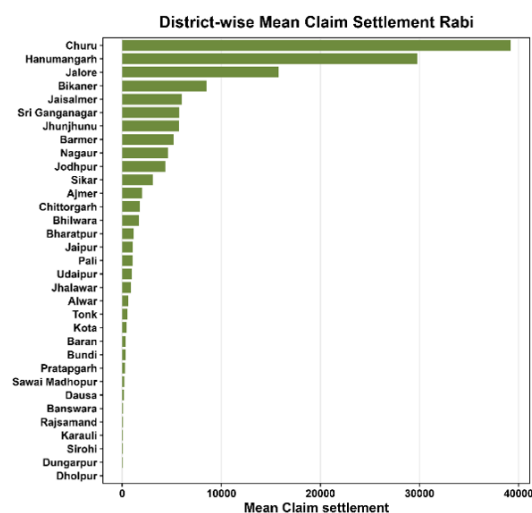
(b) Rabi

Figure 9: District-wise Mean Farmer Premium under PMFBY: Kharif and Rabi, 2018–19 to 2025–26

Source: Ministry of Agriculture and Farmers' Welfare.



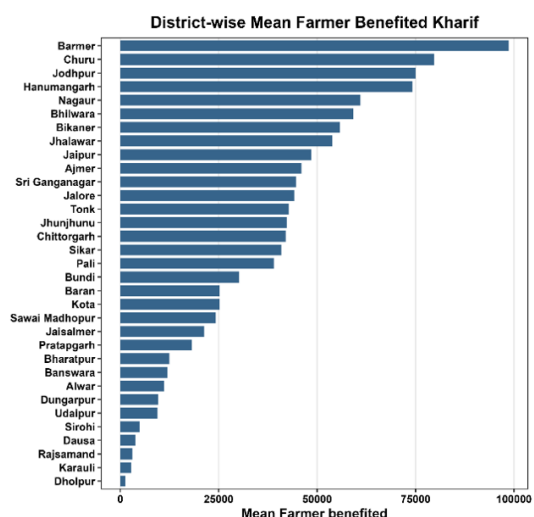
(a) Kharif



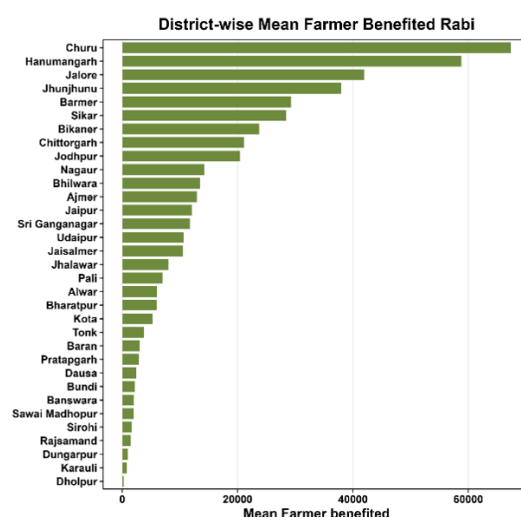
(b) Rabi

Figure 10: District-wise Mean Number of Claims Settled under PMFBY: Kharif and Rabi, 2018–19 to 2025–26

Source: Ministry of Agriculture and Farmers' Welfare.



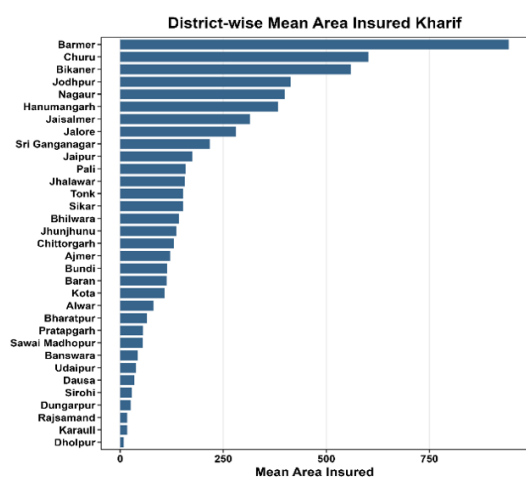
(a) Kharif



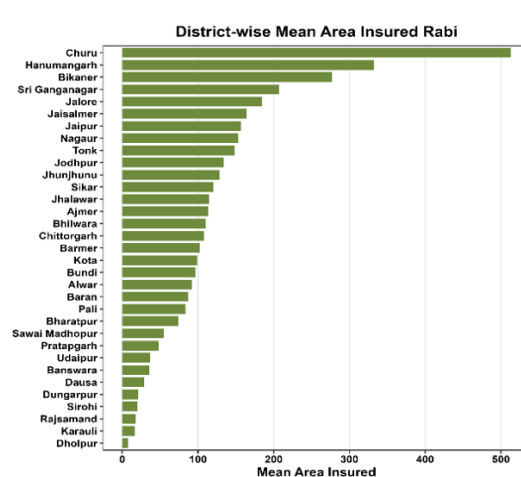
(b) Rabi

Figure 11: District-wise Mean Number of Farmers Benefited under PMFBY: Kharif and Rabi, 2018–19 to 2025–26

Source: Ministry of Agriculture and Farmers' Welfare.



(a) Kharif



(b) Rabi

Figure 12: District-wise Mean Area Insured under PMFBY: Kharif and Rabi, 2018–19 to 2025–26

Source: Ministry of Agriculture and Farmers' Welfare.

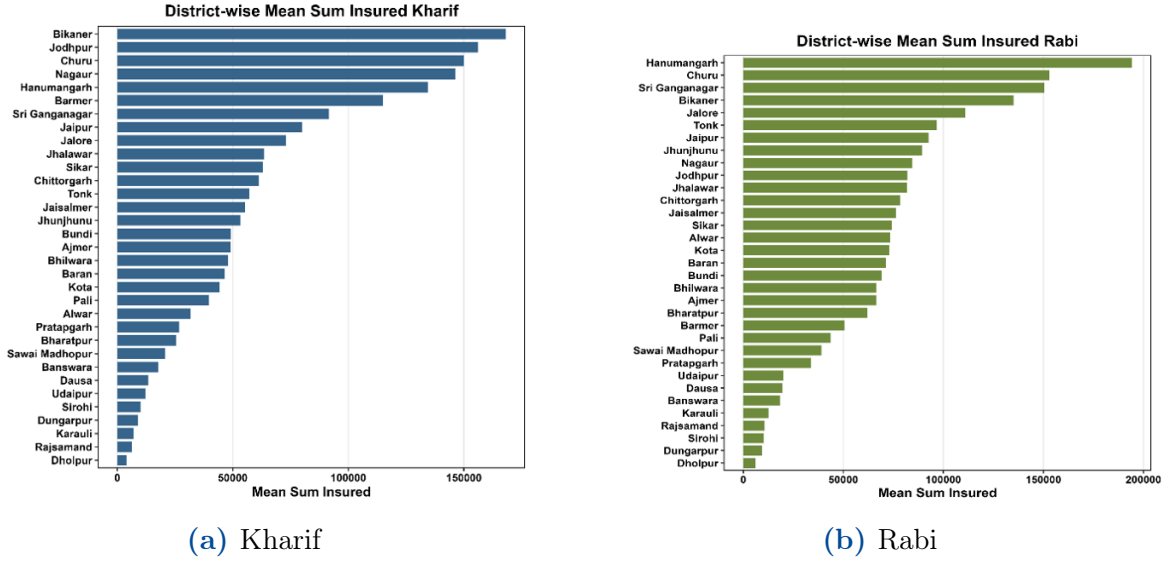


Figure 13: District-wise Mean Sum Insured under PMFBY: Kharif and Rabi, 2018–19 to 2025–26

Source: Ministry of Agriculture and Farmers' Welfare.

3.2 Regression Results

3.2.1 Determinants of PMFBY participation in Rajasthan

To analyse the factors influencing PMFBY participation, we ran separate two-way fixed-effects panel regressions for the Kharif season, Rabi season, and the combined sample. The dataset comprised district-level observations across the study period, with district and year fixed effects included in all models. The pooled models also account for season-specific effects, and the standard errors are clustered at the district level. Participation is assessed across three categories: total number of farmers insured, total number of loanee farmer applications and total number of non-loanee farmer applications. The estimates show that the previous-period PMFBY experience played a significant role in current farmer participation; however, the strength and direction of this relationship vary depending on whether the previous outcome was claims paid or number of farmers benefited, and on the type of enrolment.

Table 7 presents the estimates for overall farmer enrolment. Lagged total claims paid have a negative and statistically significant association with subsequent enrolment in all three specifications: Kharif (-0.59 , $p < 0.01$), Rabi (-0.56 , $p < 0.05$), and the pooled specification (-0.71 , $p < 0.01$). The negative association should be interpreted cautiously.

Total claims paid is an aggregate district-level measure and may reflect both the extent of losses in the preceding season and the magnitude of payouts among beneficiaries. It therefore cannot by itself distinguish between the effect of realised insurance benefits and the effect of the underlying severity of agricultural losses. Moreover the data do not contain information on the timing of individual claim settlement, farmer satisfaction or farmers' awareness of payouts before the subsequent enrolment period. Accordingly the coefficient should be interpreted as an aggregate association rather than as evidence that higher claim payments cause farmers to withdraw from PMFBY.

In contrast, the number of farmers benefited is positively and statistically significantly associated with subsequent enrolment in all three specifications (0.25–0.54, $p < 0.05$) (Table 7). The relationship is strongest in the pooled specification. This finding is consistent with the broader literature showing that previous insurance experience can influence subsequent insurance demand (Karlan et al., 2014; Cole et al., 2014; Stein, 2018). In the present setting the positive coefficient indicates that districts with a larger number of farmers benefiting from PMFBY in the preceding period tend to record greater subsequent enrolment. However the data are aggregated at the district level, the result cannot establish whether this relationship reflects individual repeat participation, demonstration effects among neighbouring farmers, greater awareness or persistence in district-level scheme participation.

Lagged farmer premium is also positively associated with overall enrolment, although the magnitude varies across seasons. This may partly reflect persistence in the scale of PMFBY operations across districts. The coefficient should therefore be interpreted as a relationship between previous-period scheme scale and subsequent enrolment rather than as an independent behavioural response to premium payments.

Table 8 and Table 9 examine the influence of previous-period scheme experience on the number of applications from loanee and non-loanee farmers. The results in Table 7 are primarily driven by the loanee segment. For loanee farmers, claim paid has a significant negative coefficient in Kharif (-19.16, $p < 0.01$) and for the pooled sample (-14.66, $p < 0.01$), but is nearly zero and insignificant in Rabi. Similarly, the farmer benefited effect is strong and positive during Kharif and in the pooled sample but insignificant during Rabi. The stronger Kharif effects may reflect greater weather-related production risk and

Table 7: Determinants of Farmers' Enrolment under PMFBY: One-Period Lagged Specification

	Kharif	Rabi	Pooled (Kharif and Rabi)
Total claims paid ($t - 1$)	-0.5925*** (0.1984)	-0.5641** (0.2668)	-0.7127*** (0.2169)
Farmers benefited ($t - 1$)	0.2531*** (0.0738)	0.3584** (0.1597)	0.5371*** (0.1123)
Farmer premium ($t - 1$)	16.9100*** (5.1150)	6.8780* (3.5790)	7.8600** (2.9920)
SC farmer population	3, 220.9 (3, 020.7)	2, 294.7 (2, 012.8)	6, 822.5*** (2, 141.4)
ST farmer population	233.4 (710.8)	262.2 (467.9)	476.3 (510.6)
OBC farmer population	204.0 (818.5)	-372.2 (341.8)	-86.79 (415.3)
Marginal farmer population	-185.8 (565.2)	780.2 (504.0)	1, 769.4*** (661.0)
Small farmer population	463.8 (348.1)	476.8 (288.6)	-404.4 (752.4)
District fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Season fixed effects	No	No	Yes
Observations	231	231	462
R^2	0.961	0.942	0.856
Adjusted R^2	0.952	0.927	0.839

Notes: The dependent variable is the number of farmers insured under PMFBY in the respective season. Claim, beneficiary, and premium variables enter the regressions with a one-period lag ($t - 1$). The Kharif and Rabi specifications include district and year fixed effects, while the pooled specification additionally includes season fixed effects. Standard errors, reported in parentheses, are clustered at the district level.

Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

more reliance on crop insurance schemes during the monsoon season (Table 8). For non-loanee farmers, none of the claim paid or farmer benefited variables were statistically significant across any specifications (Table 9). This finding suggests that voluntary, non-credit-linked enrolment is largely unaffected by the scheme's prior performance. Instead, non-loanee farmers seem to base their enrolment decisions on factors outside this model, such as extension efforts, risk perception, liquidity, or awareness campaigns. This aligns with the widely observed low voluntary uptake of PMFBY nationwide.

Regarding social composition, limited evidence suggests some heterogeneity: in the pooled model, SC and marginal farmers show positive associations with overall enrolment, while in the non-loanee model, ST and OBC farmers have significant positive links. These

Table 8: Determinants of Loanee Farmer Enrolment under PMFBY: One-Period Lagged Specification

	Kharif	Rabi	Pooled (Kharif and Rabi)
Total claims paid ($t - 1$)	-19.160*** (6.866)	0.737 (3.853)	-14.660*** (5.464)
Farmers benefited ($t - 1$)	6.411*** (2.025)	1.180 (3.030)	6.566*** (1.643)
Farmer premium ($t - 1$)	-59.480 (88.060)	7.074 (40.210)	-3.985 (29.590)
SC farmer population	17,526.8 (31,656.8)	-21,632.7 (29,845.0)	-2,556.4 (23,335.1)
ST farmer population	14,671.4 (12,746.5)	2,817.8 (6,531.1)	3,873.6 (6,020.4)
OBC farmer population	31,573.9** (16,220.8)	10,068.2 (8,184.5)	10,572.5 (7,074.0)
Marginal farmer population	-9,635.3 (12,074.3)	-3,139.8 (10,902.9)	1,744.9 (7,693.2)
Small farmer population	-8,537.1 (6,894.4)	1,804.0 (14,414.5)	-8,858.1 (8,351.7)
District fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Season fixed effects	No	No	Yes
Observations	231	231	462
R^2	0.866	0.803	0.792
Adjusted R^2	0.832	0.754	0.769

Notes: The dependent variable is the number of loanee farmer applications under PMFBY in the respective season. Claim, beneficiary, and premium variables enter the regressions with a one-period lag ($t - 1$). The Kharif and Rabi specifications include district and year fixed effects, while the pooled specification additionally includes season fixed effects. Standard errors, reported in parentheses, are clustered at the district level.

Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

findings imply that social and landholding characteristics influence participation patterns but not necessarily at the individual level.

Table 9: Determinants of Non-Loanee Farmer Enrolment under PMFBY: One-Period Lagged Specification

	Kharif	Rabi	Pooled (Kharif and Rabi)
Total claims paid ($t - 1$)	-4.405 (3.085)	-0.118 (1.115)	-2.095 (2.218)
Farmers benefited ($t - 1$)	1.528 (0.959)	0.897 (0.886)	1.059 (0.696)
Farmer premium ($t - 1$)	-8.376 (24.490)	2.265 (7.909)	-3.474 (8.557)
SC farmer population	-4, 215.5 (7, 055.9)	-5, 502.6 (3, 964.3)	-3, 003.2 (3, 660.6)
ST farmer population	4, 212.8* (2, 109.9)	937.5 (1, 196.4)	2, 556.2** (1, 261.3)
OBC farmer population	5, 539.7*** (2, 515.3)	1, 783.1 (1, 185.4)	3, 244.2*** (1, 295.4)
Marginal farmer population	-1, 625.2 (2, 056.4)	250.4 (960.9)	-462.7 (1, 089.4)
Small farmer population	2, 382.5 (1, 811.5)	4, 142.2 (3, 741.6)	2, 985.0 (2, 015.7)
District fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Season fixed effects	No	No	Yes
Observations	231	231	462
R^2	0.775	0.728	0.718
Adjusted R^2	0.719	0.660	0.686

Notes: The dependent variable is the number of non-loanee farmer applications under PMFBY in the respective season. Claim, beneficiary, and premium variables enter the regressions with a one-period lag ($t - 1$). The Kharif and Rabi specifications include district and year fixed effects, while the pooled specification additionally includes season fixed effects. Standard errors, reported in parentheses, are clustered at the district level.

Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

3.2.2 West vs East Heterogeneity

The descriptive analysis revealed a clear spatial divide in PMFBY performance, with most western districts, on average, performing better than the eastern districts. To determine whether the factors influencing participation vary geographically, we added interaction terms between a western-district indicator and the lagged programme performance variables to the model (eastern districts as the reference, (Tables 10–12). The interaction terms show that the impact of previous insurance experience varies by region, especially regarding realised benefits and claim payments.

Regarding overall farmer enrolment (Table 10), lagged farmer benefited show a posi-

tive and significant interaction with West during Rabi (0.649, $p < 0.05$) and in the pooled model (0.529, $p < 0.01$). In the pooled analysis, the primary effect is 0.244, yielding an estimated combined effect of approximately 0.773 for western districts, compared with 0.244 for the eastern reference group. This suggests that there is a strong association between the previous-period beneficiaries and upcoming enrolment in Western Rajasthan, reflecting strong demonstration or confidence effects, where PMFBY participation and institutional penetration are already relatively high. Conversely, the interaction between lagged farmer premiums and west is negative and significant in Rabi (-14.07, $p < 0.10$) and the pooled model (-12.80, $p < 0.01$), indicating that the connection between past premium mobilisation and future enrolment is less pronounced in western districts. The interaction involving lagged claims and west typically remains insignificant, implying limited regional differences in the claim-enrolment relationship for overall participation.

The regional differences in loanee enrolment (Table 11) are notably more distinct. The interaction between lagged claim paid and West is negative and significant during Kharif (-19.9, $p < 0.1$) and in the combined model (-17.83, $p < 0.05$). Thus the association between previous-period claims and subsequent loanee enrolment is more negative in Western districts relative to the eastern reference group. This result should not, however, be interpreted as evidence of greater dissatisfaction with claim settlement in Western Rajasthan because the district-level data do not measure satisfaction, settlement delays or the timing of payouts.

Conversely, for West x lagged farmers benefited, the interaction is positive and significant in Kharif (5.897, $p < 0.10$) and highly significant in the pooled model (8.703, $p < 0.01$). In the pooled analysis, the baseline effect for eastern districts is 0.853, which translates to roughly 9.56 for western districts. This points to a much stronger positive link between farmers who benefited in the previous period and subsequent loanee participation in western Rajasthan. The finding is consistent with the possibility that realised scheme experience is more strongly associated with subsequent participation in areas where PMFBY penetration is already relatively high, although the aggregate data do not allow the underlying mechanism to be identified.

The interaction between the west and lagged farmer premium is negative and statistically significant in the pooled model (-115.80, $p < 0.10$) and statistically insignificant in

Table 10: Differential Impact on Farmer Enrolment: Western versus Eastern Districts

	Kharif	Rabi	Pooled (Kharif and Rabi)
Total claims paid ($t - 1$)	-0.8664*** (0.2556)	0.2788 (0.7369)	-0.8141*** (0.2768)
Farmers benefited ($t - 1$)	0.2755*** (0.0906)	0.0512 (0.1510)	0.2437* (0.0998)
Farmer premium ($t - 1$)	18.720 (11.330)	20.180*** (5.644)	18.510*** (4.360)
SC farmer population	3,430.6 (2,932.1)	1,962.1 (1,833.3)	6,413.2*** (2,128.6)
ST farmer population	271.6 (740.5)	120.9 (515.0)	698.2 (502.0)
OBC farmer population	279.4 (733.6)	30.33 (313.1)	603.9* (361.8)
Marginal farmer population	-143.5 (564.6)	850.1 (515.6)	1,772.4*** (611.4)
Small farmer population	435.2 (332.7)	325.7 (310.3)	-310.2 (690.4)
<i>Western district interaction terms</i>			
Total claims paid ($t - 1$) $\times$ West	0.3292 (0.2821)	-1.296* (0.7508)	-0.1541 (0.3926)
Farmers benefited ($t - 1$) $\times$ West	-0.0203 (0.0895)	0.6487** (0.2392)	0.5291*** (0.1914)
Farmer premium ($t - 1$) $\times$ West	-2.546 (9.977)	-14.07* (5.473)	-12.80*** (4.461)
District fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Season fixed effects	No	No	Yes
Observations	231	231	462
R^2	0.962	0.948	0.870
Adjusted R^2	0.951	0.934	0.854

Notes: The dependent variable is the number of farmers insured under PMFBY in the respective season. Claim, beneficiary, and premium variables enter the regressions with a one-period lag ($t - 1$). West refers to the western districts, with eastern districts serving as the reference group. Interaction terms between the lagged explanatory variables and the West indicator capture the differential association for western districts relative to the eastern-district reference group. The Kharif and Rabi specifications include district and year fixed effects, while the pooled specification additionally includes season fixed effects. Standard errors, reported in parentheses, are clustered at the district level.

Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

separate Kharif and Rabi models. The east base effect is positive and significant (95.73, $p < 0.10$), while the implied coefficient for western districts is about -20.07. This suggests that the impact of premium collection in the previous period is less in western districts, and the relationship between premium and loanee enrolment may reverse in these areas.

For non- loanee enrolment (Table 12), the results again show notable regional differences. The West $\times$ lagged claim interaction is negative and significant in Kharif (-8.402,

Table 11: Differential Association with Loanee Farmer Enrolment: Western versus Eastern Districts

	Kharif	Rabi	Pooled (Kharif and Rabi)
Total claims paid ($t - 1$)	-3.998 (4.177)	5.863 (31.740)	-1.583 (4.461)
Farmers benefited ($t - 1$)	2.251* (1.121)	-2.839 (4.855)	0.853 (1.219)
Farmer premium ($t - 1$)	65.58 (91.57)	109.80 (86.11)	95.73* (49.01)
SC farmer population	11,669.7 (33,295.7)	-28,741.0 (32,041.4)	-8,994.2 (23,552.2)
ST farmer population	13,555.0 (12,022.9)	2,833.8 (6,883.5)	6,101.2 (6,137.0)
OBC farmer population	30,815.9** (15,057.4)	14,995.3* (8,209.8)	17,857.2** (7,138.9)
Marginal farmer population	-9,425.4 (12,208.7)	-1,977.4 (10,503.0)	733.1 (7,521.3)
Small farmer population	-8,384.0 (6,611.6)	-525.9 (13,350.4)	-7,771.6 (7,859.0)
<i>Western district interaction terms</i>			
Total claims paid ($t - 1$) $\times$ West	-19.90* (8.280)	-13.11 (31.64)	-17.83** (6.822)
Farmers benefited ($t - 1$) $\times$ West	5.897* (2.731)	10.07 (6.936)	8.703*** (2.002)
Farmer premium ($t - 1$) $\times$ West	-113.70 (112.40)	-108.60 (98.43)	-115.80* (53.76)
District fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Season fixed effects	No	No	Yes
Observations	231	231	462
R^2	0.874	0.812	0.813
Adjusted R^2	0.840	0.762	0.790

Notes: The dependent variable is the number of loanee farmer applications under PMFBY in the respective season. Claim, beneficiary, and premium variables enter the regressions with a one-period lag ($t - 1$). West refers to the western districts, with eastern districts serving as the reference group. Interaction terms between the lagged explanatory variables and the West indicator capture the differential association for western districts relative to the eastern-district reference group. The Kharif and Rabi specifications include district and year fixed effects, while the pooled specification additionally includes season fixed effects. Standard errors, reported in parentheses, are clustered at the district level.

Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

$p < 0.05$), Rabi (-3.786, $p < 0.10$), and the combined model (-4.609, $p < 0.10$). In the combined model, the main effect of lagged claims for the eastern reference group is 1.490; thus, the implied coefficient is -3.12 for western districts. Higher claims in the previous season are linked to increased non-loanee enrolment in eastern districts, but this relationship turns negative in western districts. This is notable since the claim variable was

statistically insignificant when districts were analysed collectively, revealing significant regional differences. Additionally, the negative link in western districts aligns with earlier findings for overall and loanee enrolment, where prior claim payments also correlated negatively with later participation. The West $\times$ lagged benefit interaction is positive and marginally significant in Kharif (2.419, $p < 0.10$) and the pooled model (1.721, $p < 0.10$), implying that benefit realisation is more strongly linked to voluntary participation in western districts. The premium interaction remains insignificant across all models.

Overall, the results show that the western districts react more strongly to the previous period no of farmers benefited. They also display a stronger significant negative link between past claim payments and future participation, especially among loanee farmers. The consistent West $\times$ lagged benefit effect across the three dimensions, along with negative West $\times$ lagged claim effects for loanee and non-loanee segments, indicates that the western advantage in PMFBY is influenced not just by higher historical coverage but also by farmers' perceptions and responses to previous insurance outcomes.

Table 12: Differential Association with Non-Loanee Farmer Enrolment: Western versus Eastern Districts

	Kharif	Rabi	Pooled (Kharif and Rabi)
Total claims paid ($t - 1$)	1.864* (0.713)	1.702 (1.451)	1.490* (0.665)
Farmers benefited ($t - 1$)	-0.133 (0.141)	-0.187 (0.283)	-0.123 (0.144)
Farmer premium ($t - 1$)	-4.890 (16.080)	-21.890 (17.900)	-10.640 (11.450)
SC farmer population	-7,800.6 (6,859.2)	-7,741.7 (4,960.8)	-4,408.6 (3,788.8)
ST farmer population	4,500.0*** (1,886.1)	1,833.8 (1,426.4)	3,137.6*** (1,450.1)
OBC farmer population	5,860.5*** (2,425.7)	2,252.8 (1,510.5)	4,157.6*** (1,649.8)
Marginal farmer population	-2,061.7 (1,777.0)	512.5 (1,140.0)	-836.1 (1,023.9)
Small farmer population	2,614.3 (1,581.2)	3,728.8 (3,212.6)	3,163.9 (1,990.4)
<i>Western district interaction terms</i>			
Total claims paid ($t - 1$) $\times$ West	-8.402** (3.570)	-3.786* (2.200)	-4.609* (2.657)
Farmers benefited ($t - 1$) $\times$ West	2.419* (1.266)	2.548 (1.855)	1.721* (0.947)
Farmer premium ($t - 1$) $\times$ West	10.680 (19.890)	26.030 (17.350)	8.123 (10.010)
District fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Season fixed effects	No	No	Yes
Observations	231	231	462
R^2	0.812	0.748	0.736
Adjusted R^2	0.762	0.680	0.704

Notes: The dependent variable is the number of non-loanee farmer applications under PMFBY in the respective season. Claim, beneficiary, and premium variables enter the regressions with a one-period lag ($t - 1$). West refers to the western districts, with eastern districts serving as the reference group. Interaction terms between the lagged explanatory variables and the West indicator capture the differential association for western districts relative to the eastern-district reference group. The Kharif and Rabi specifications include district and year fixed effects, while the pooled specification additionally includes season fixed effects. Standard errors, reported in parentheses, are clustered at the district level.

Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

3.3 Post-2020 Trend Analysis

This section investigates whether PMFBY participation has changed before or after 2020, using 2019 as the reference year. The pre-treatment coefficient at $t = -1$ (2019) is set to zero and signifies enrolment in the final year of compulsory loanee coverage. Therefore,

all coefficients after 2020 are interpreted in reference to this benchmark, showing change after farmers gained the right to exit rather than growth under a fixed mandate.

All districts (pooled)

Overall enrolment (number of farmers insured; (Figure 14a) shows an upward trend from $t=0$ (2020). It increases from around 10,000 to a steady range of 12,000-14,000 between $t=1$ (2021) and $t = 4$ (2024), reaching about 22,000 by $t=5$ (2025). The confidence intervals for the years - 2020-2023 and 2026 exclude zero. The pattern indicates continued participation in PMFBY after the transition to voluntary enrolment, although the year coefficients should be interpreted as changes relative to 2019 rather than causal effects of the reform.

The number of loanee applications (Figure 14b) exhibits the most distinct pattern, beginning around 50,000 at $t = 0$; it rises sharply to around 380,000 by $t=1$ and stays elevated (380,000-500,000) through $t=5$, with confidence intervals excluding zero at all post-treatment points. Since loanee participation became voluntary from Kharif 2020, this pattern indicates substantial retention and expansion of loanee participation following the removal of the mandatory requirement. However, it does not establish that the reform itself caused the increase because the analysis does not have a conventional untreated comparison group.

The number of non-loanee applications (Figure 14c), unlike the loanee group, does not correspond much to the rule change. Since voluntary enrolment was always the norm for this group, this trend should be considered as a general post-2020 pattern, rather than a response to reform. The estimated effect appears flat and statistically indistinguishable from zero from $t=0$ to 2, only increasing at $t=4$ and 5 (around 20,000-38,000) with wide confidence intervals, suggesting that this group's participation changed independently and more slowly than the loanee channel's response to the scheme. The relatively weaker movement in this series provides a useful descriptive contrast with the stronger increase observed for loanee applications.

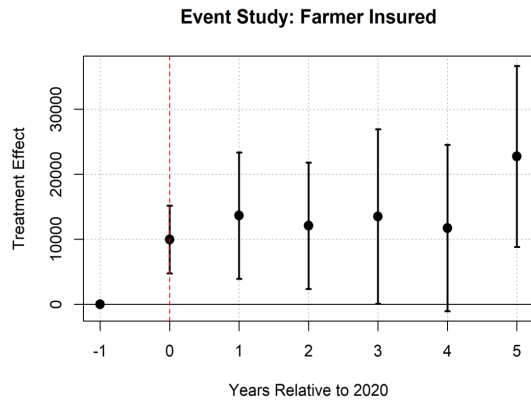
Western versus Eastern Districts

The regional decomposition indicates that post-2020 participation patterns were not uniform across Rajasthan. The overall enrolment series for Western and Eastern districts follows a broadly similar direction but differs in magnitude and precision across years (Figure 14d).

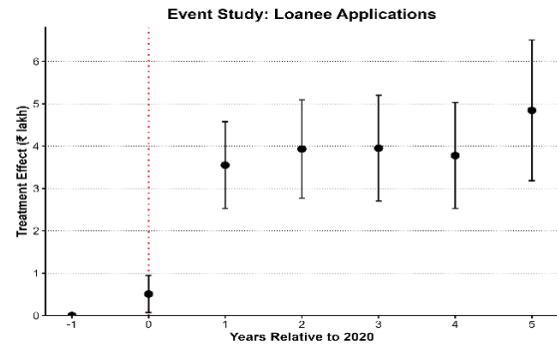
The loanee series (Figure 14e) shows a more pronounced increase in Western Rajasthan during the post-2020 period (around 350,000 to 450,000 by $t=1$ to 3, about 550,000 by $t=5$). This pattern is consistent with the stronger regional associations observed in the panel regressions, particularly for previous-period farmers benefited. However the wider confidence intervals for some years indicate that the regional differences should be interpreted with caution.

The non-loanee series for West versus East (Figure 14f) shows the weakest, most gradually developing pattern, slowly rising to 85,000 to 90,000 by $t=4$ and 5 but with intervals crossing zero at nearly every point before $t=4$. Although the confidence intervals are fairly wide, the trend indicates that Western Rajasthan saw an increase in participation, even amongst farmers not relying on institutional agricultural credit.

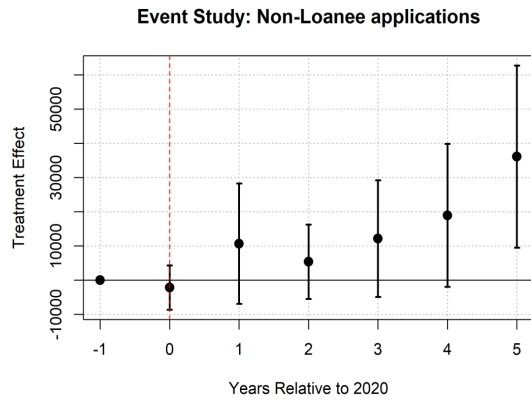
Taken together, the post-2020 analysis shows continued PMFBY participation after the transition to voluntary enrolment, with particularly pronounced growth in the loanee segment and stronger post-2020 movements in Western Rajasthan. These findings describe changes around the reform period but do not by themselves identify the causal effect of the 2020 policy change.



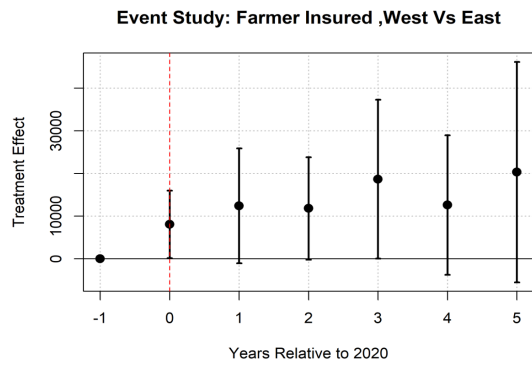
(a) Farmers Insured



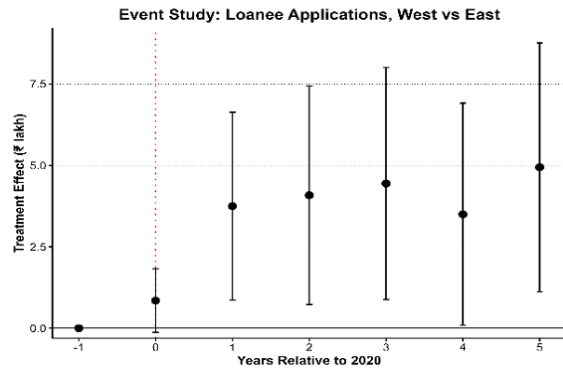
(b) Loanee Applications



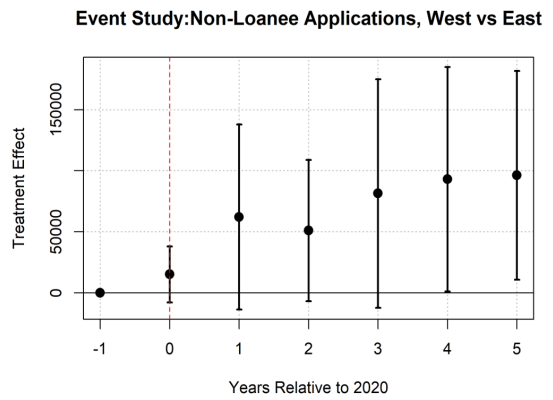
(c) Non-Loanee Applications



(d) Farmers Insured: West vs East



(e) Loanee Applications: West vs East



(f) Non-Loanee Applications: West vs East

Figure 14: Dynamic Effects of PMFBY on Farmer Enrolment and Differential Effects across Western and Eastern Districts

Source: Author's estimates based on Ministry of Agriculture and Farmers' Welfare data.

4. Discussion and Conclusion

This paper analysed the spatial, seasonal, and temporal performance of PMFBY in Rajasthan from 2018-19 to 2025-26. Using district-level panel data, the analysis considered differences in PMFBY’s performance indicators across Kharif and Rabi seasons, differences between Western and Eastern Rajasthan, the relationship between previous period scheme outcomes and subsequent enrollment and changes in participation following the transition to voluntary enrollment in 2020.

Descriptive evidence shows that Rajasthan has become a key contributor to PMFBY at the national level, with its coverage consistently exceeding the national average. However, participation by non-loanee farmers remains low — under 8% compared to the national range of 17-43%— suggesting that Rajasthan’s strong coverage masks narrow, credit-dependent engagement. During Kharif, the farmer-benefited ratio surpasses national figures which can be indicative of better implementation of PMFBY in Rajasthan. Kharif is characterised by larger gross premiums, higher claim payments and increased government subsidy support while Rabi tends to have higher insured amounts. This leads to a greater total premium rate during the Kharif season, thus highlighting the risky nature of the Kharif season.

The panel estimates provide evidence of a systematic relationship between previous-period scheme outcomes and subsequent enrollment. The number of farmers benefited in the preceding period is positively associated with subsequent enrollment across the main specifications. This finding is consistent with the broader literature showing that previous insurance experience can influence subsequent demand (Karlan et al., 2014; Cole et al., 2014; Stein, 2018). In particular previous payout experience has been shown in experimental and commercial settings to influence subsequent insurance demand. The present study complements this literature by documenting a positive association between district-level beneficiary coverage and subsequent PMFBY enrolment in Rajasthan.

However, the interpretation differs from that of individual-level studies. The present data are aggregated at the district level and therefore cannot establish whether the observed relationship results from individual repeat participation, peer effects, greater awareness, or persistence in scheme operations. The positive coefficient on farmers bene-

fited should consequently be understood as evidence of association rather than as a direct causal estimate of behavioural learning.

In contrast, lagged total claims paid are negatively associated with subsequent enrolment particularly among loanee farmers and in Western Rajasthan. This result should not be interpreted as evidence that higher claim payments generate dissatisfaction or discourage farmers from participating. Total claims paid is an aggregate outcome that may reflect both the severity of agricultural losses and the magnitude of payouts among beneficiaries. Furthermore the available data do not identify the timing of individual claim settlement relative to the subsequent enrolment decision, nor do they measure farmer satisfaction, claim-settlement delays, awareness of payouts or perceived value of the scheme. The negative coefficient therefore identifies an aggregate association whose behavioural mechanism remains unresolved.

The regional analysis reveals a persistent difference between Western and Eastern Rajasthan. Western districts generally record higher levels of PMFBY participation while the relationship between previous-period scheme outcomes and subsequent enrollment also varies across regions. In particular the positive association between previous-period farmers benefited and subsequent loanee enrollment is stronger in Western districts. At the same time the negative association between previous claims and loanee enrollment is more pronounced in Western Rajasthan. These patterns demonstrate regional heterogeneity in the relationship between scheme experience and participation but they do not by themselves identify the underlying behavioural mechanisms.

The post-2020 analysis shows that PMFBY participation continued after the transition from mandatory to voluntary enrolment for loanee farmers. Loanee applications increased substantially relative to the 2019 reference period and remained elevated in subsequent years while non-loanee participation exhibited a more gradual pattern. The stronger movement in the loanee segment is descriptively consistent with substantial retention of participation after the mandatory requirement was removed. Nevertheless the available specification has only one pre-reform reference period and does not provide a conventional untreated comparison group, these estimates should be interpreted as post-2020 participation dynamics rather than definitive causal effects of the reform.

The findings have several implications for PMFBY implementation. First, the positive

association between previous beneficiary coverage and subsequent enrollment indicates the importance of ensuring that farmers who receive legitimate benefits experience the scheme as timely and transparent. Second, the regional heterogeneity suggests that implementation strategies may need to account for differences in agricultural risk, insurance penetration, institutional arrangements and farming systems across Rajasthan. Third, the relatively low participation of non-loanee farmers indicates scope for strengthening awareness, extension outreach and voluntary enrolment mechanisms among farmers who are not linked to institutional credit.

The study has important limitations. First, district-level administrative data cannot directly capture farmer-level awareness, trust, risk perceptions, satisfaction or reasons for participation. Second, the timing of claim settlement is not observed at the individual level, limiting interpretation of lagged claims as information available before subsequent enrolment. Third, the post-2020 analysis has only one pre-reform reference period after accounting for lagged variables, preventing a conventional assessment of parallel pre-trends. Consequently the reform estimates should not be interpreted as definitive causal effects. Finally some district-level social and landholding variables are measured in aggregate form which limits their interpretation as individual characteristics.

Overall, PMFBY has achieved substantial coverage in Rajasthan but its performance varies across seasons, regions and farmer categories. The evidence indicates that previous scheme experience is associated with subsequent participation while the direction and strength of this relationship differ between beneficiary outcomes and aggregate claims. The findings also show continued participation after the transition to voluntary enrollment particularly among loanee farmers. Future research combining administrative panel data with farmer-level surveys could directly examine the mechanisms suggested by these results including awareness, trust, claim-settlement experience, risk perceptions, social learning and the timing of insurance payouts.

References

Aditya, K. S., Khan, T., & Kishore, A. (2018). Adoption of crop insurance and impact: Insights from India. *Agricultural Economics Research Review*, 31(2), 163–174.

- Afreen, A., & Mishra, N. (2025). *From floods to drought: The 2025 climate story of India*. Centre for Environment and Energy Development. <https://ceedindia.org/from-floods-to-drought-the-2025-climate-story-of-india/>
- Biswal, D., & Bahinipati, C. S. (2025). Demand for crop insurance in India: Evidence from national representative surveys. *The Indian Economic Journal*. <https://doi.org/10.1177/00194662251334801>
- Cole, S., Stein, D., & Tobacman, J. (2014). (2014) Dynamics of demand for index insurance: Evidence from a long-run field experiment. *American Economic Review*, 104(5), 284–290. <https://doi.org/10.1257/aer.104.5.284>
- Dhayal, B. L., Bairathi, R., & Malik, A. K. (2018). Knowledge level of farmers towards Pradhan Mantri Crop Insurance Scheme (PM-CIS): A study of Udaipur district of Rajasthan. *International Journal of Education & Management*, 8(3), 374–376.
- Food and Agriculture Organization of the United Nations. (2013). *Managing risk in farming*. Food and Agriculture Organization of the United Nations. <https://www.fao.org/4/i3229e/i3229e.pdf>
- Government of India, Ministry of Finance. (2026). *Economic survey 2025–26*. Department of Economic Affairs. <https://www.indiabudget.gov.in/economicsurvey/>
- Government of Rajasthan. (2022). *State action plan on climate change*. Department of Environment. https://environment.rajasthan.gov.in/content/environment/en/environmental-information-system/State_Action_Plan.html
- Government of Rajasthan, Directorate of Economics and Statistics. (2026a). *Economic review 2025–26*. Finance Department, Government of Rajasthan. <https://finance.rajasthan.gov.in/docs/budget/statebudget/2026-2027/Economicreviewe.pdf>
- Government of Rajasthan. (2026b). *Physiography of*

<https://environment.rajasthan.gov.in/content/environment/en/rajasthan-state-biodiversity-board/about-rajasthan/physiography-of-rajasthan.html>

Government of Rajasthan. (2026c). *Rajasthan at a glance*. Rajasthan State Biodiversity Board.

Gupta, A., Asopa, A., Sharma, S., Baghla, P., & Chaudhary, K. R. (2025). Analysis and financial evaluation of the Pradhan Mantri Fasal Bima Yojana in Jhalawar district, Rajasthan (2018–2023). *Rajasthali Journal*, 4(3), 10–19.

Hazell, P. B. R. (1992). The appropriate role of agricultural insurance in developing countries. *Journal of International Development*, 4(6), 567–581. <https://doi.org/10.1002/jid.3380040602>

Highland Post. (2026). *The Earth weeps: A cry for balance in a changing world*. <https://highlandpost.com/the-earth-weep-a-cry-for-balance-in-a-changing-world/>

2021 Intergovernmental Panel on Climate Change (2021). *Climate Change 2021: The Physical Science Basis*. Cambridge University Press, Cambridge. <https://doi.org/10.1017/9781009157896>

2015 John, S.T., & Philip, M.S. (2025). Development of an agricultural drought vulnerability index for risk assessment, insurance pricing, and disaster management through Google Earth Engine. *Discover Geoscience*, 3, 107. <https://doi.org/10.1007/s44288-025-00223-5>

Kanwal, V., Sirohi, S., & Chand, P. (2022). Risk perception, impact, and management by farmer households in Rajasthan (India). *Environmental Hazards*, 21(5), 416–432. <https://doi.org/10.1080/17477891.2022.2035664>

Karlan, D., Osei, R., Osei-Akoto, I., & Udry, C. (2014). (2014) Agricultural decisions after relaxing credit and risk constraints. *The Quarterly Journal of Economics*, 129(2), 597–652. <https://doi.org/10.1093/qje/qju002>

Kapadia, K., & Swain, M. (2020). Agricultural insurance as a risk management tool:

- Comparative performance of NAIS and PMFBY in Gujarat. *Indian Journal of Economics and Development*, 16(2), 168–175.
- Kaur, S., Raj, H., Singh, H., & Chattu, V. K. (2021). Crop Insurance Policies in India: An Empirical Analysis of Pradhan Mantri Fasal Bima Yojana. *Risks*, 9(11), 191. <https://doi.org/10.3390/risks9110191>
- Kaur, S., Singh, H., Roy, D., & Singh, H. (2024). Prospects of crop insurance for sustenance of farmers' livelihood during GM cotton crop failure in Indian Punjab. *Journal of Agribusiness in Developing and Emerging Economies*. <https://doi.org/10.1108/JADEE-06-2023-0142>
- 2016 Ministry of Agriculture & Farmers Welfare (2016). *Operational Guidelines: Pradhan Mantri Fasal Bima Yojana*. Department of Agriculture, Cooperation and Farmers Welfare, Government of India.
- Mishra, P. K. (1994). Crop insurance and crop credit: Impact of the Comprehensive Crop Insurance Scheme on cooperative credit in Gujarat. *Journal of International Development*, 6(5), 529–567. <https://doi.org/10.1002/jid.3380060505>
- Mundetia, N., & Sharma, D. (2015). Analysis of rainfall and drought in Rajasthan State, India. *Global NEST Journal*, 17(1), 12–21. <https://doi.org/10.30955/gnj.001379>
- NABARD. (2021). *State focus paper: Rajasthan 2021–22*. National Bank for Agriculture and Rural Development.
- Natwadia, R., Yadav, J. P., Pramod, Choudhary, K., & Choudhary, M. (2025). Relationship between knowledge of beneficiary farmers about Pradhan Mantri Fasal Bima Yojana (PMFBY) and their selected independent variables. *International Journal of Agriculture Extension and Social Development*, 8(4), 477–481. <https://doi.org/10.33545/26180723.2025.v8.i4g.1815>
- Nikita, & Sharma, R. (2024). Identification of various constraints faced by farmers in adopting government schemes in the state of Rajasthan, India. *Asian Journal of Agricultural Extension, Economics & Sociology*, 42(4), 123–130. <https://doi.org/10.9734/AJAEES/2024/v42i42402>

- Patel, S., Mehta, D., Kumar, V., Patel, S., & Tiwari, D. K. (2024). Trend analysis of precipitation and drought characteristics over Churu district of north-east Rajasthan, India. *Journal of Water and Climate Change*, 15(9), 4457–4476. <https://doi.org/10.2166/wcc.2024.144>
- Punia, M., Nimbrayan, P. K., & Yadav, K. K. (2021). Problems, prospects and policy recommendations of crop insurance schemes. *Asian Journal of Agricultural Extension, Economics & Sociology*, 39(5), 1–9. <https://doi.org/10.9734/ajaees/2021/v39i530572>
- Raju, S. S., & Chand, R. (2008). A study on the performance of National Agricultural Insurance Scheme and suggestions to make it more effective. *Agricultural Economics Research Review*, 21(1), 11–19. <https://doi.org/10.1177/0971344120080103>
- Rathore, V. (2026). *The role of Pradhan Mantri Fasal Bima Yojana in the economy of Churu district*. SSRN.
- Senthil Kumar, G., Karmakar, P. S., Bisherwal, M. A., Abhilash, P., & Rana, M. (2023). Block level yield estimation for generating yield proxies in crop insurance sectors: A case study of Hanumangarh district, Rajasthan. *International Journal of Agriculture Sciences*, 15(9), 12650–12653.
- Sheoran, V., & Kait, R. (2023). Evaluation of the crop insurance performance in Haryana. *Economic and Regional Studies*, 16(1), 133–142.
- Shrimali, D., Agarwal, K., & Dash, D. N. (2023). Assessing the impact of Pradhan Mantri Fasal Bima Yojana (PMFBY) on farmers of tribal area of Southern Rajasthan. *Pacific Business Review International*, 15(12), 98–110.
- Singh, P., & Agrawal, G. (2020). Development, present status and performance analysis of agriculture insurance schemes in India: Review of evidence. *International Journal of Social Economics*, 47(4), 461–481.
- Singh, R. B., & Kumar, A. (2016). Agriculture dynamics in response to climate change in Rajasthan. *The Delhi University Journal of the Humanities and the Social Sciences*, 3, 115–138.

- Singh, V. K., Prasad, J. V. N. S., Indoria, A. K., Kundu, S., Ramana, D. B. V., Rejani, R., Prabhakar, M., Rohilla, P. P., Singh, S. K., Mishra, J. P., Singh, R., Chaudhari, S. K., & Gautam, U. S. (Eds.). (2023). *Promising climate resilient technologies for Rajasthan*. ICAR–Central Research Institute for Dryland Agriculture.
- Stein, D. (2018). (2018) Dynamics of demand for rainfall index insurance: Evidence from a commercial product in India. *The World Bank Economic Review*, 32(3), 692–708. <https://doi.org/10.1093/wber/lhw045>
- Swain, M. (2014). *Crop insurance for adaptation to climate change in India*. Asia Research Centre Working Paper 61. London School of Economics and Political Science. [https://sticerd.lse.ac.uk/textonly/india/publications/working_papers/ARCWP61 – Swain.pdf](https://sticerd.lse.ac.uk/textonly/india/publications/working_papers/ARCWP61_Swain.pdf)
- Swain, M. (2023). Redesigning crop insurance for coping with climate change in India. *Indian Journal of Applied Economics and Business*, 5(1), 107–128. <https://doi.org/10.47509/IJAEB.2023.v05i01.06>
- 2019 Tanwar, A., Kaur, M., Bareth, L.S., & Johri, S.K. (2019). Knowledge of wheat growers about Pradhan Mantri Fasal Bima Yojana. *International Journal of Current Microbiology and Applied Sciences*, 8(7), 1761–1768. <https://doi.org/10.20546/ijcmas.2019.807.209>
- Tiwari, R., Chand, K., & Anjum, B. (2020). Crop insurance in India: A review of Pradhan Mantri Fasal Bima Yojana (PMFBY). *FIIB Business Review*, 9(4), 249–255.
- Ullah, R., Shivakoti, G. P., Zulfiqar, F., & Kamran, M. A. (2016). Farm risks and uncertainties: Sources, impacts and management. *Outlook on Agriculture*, 45(3), 199–205. <https://doi.org/10.1177/0030727016665440>
- World Bank (2018). Agriculture Risk Resilience and Insurance Access Program. World Bank, Washington, DC.