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Impact of Minimum Support Price (MSP), climate change, and market access on agricultural productivity: Evidence from rural India

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Abstract

This study investigates how Minimum Support Price (MSP), climate variability, and market access jointly influence agricultural productivity and farm income in rural India. Using secondary panel data (2010-2023) and econometric modeling, the paper estimates a multiple regression model to quantify the effects of rainfall variability, temperature, MSP coverage, and market connectivity on crop yield and income. Results show that MSP access and market connectivity significantly improve farmer income, while temperature rise and rainfall variability negatively affect productivity. The study recommends strengthening MSP outreach, investing in rural infrastructure, and promoting climate-resilient agriculture.

Keywords: Agricultural economics, MSP, climate change, market access, productivity, India

1. Introduction

Agriculture remains the backbone of the Indian economy, employing nearly half of the workforce. However, the sector faces structural challenges such as climate change, price volatility, and weak market integration. Government interventions like Minimum Support Price (MSP) aim to stabilize farmer income, but their effectiveness varies across regions. This study integrates MSP, climate, and market access into a unified framework.

1.1 Background of the Study

Agriculture remains the backbone of the Indian economy, providing employment to nearly half of the nation's workforce. Despite its importance, the sector faces significant structural challenges, including the adverse effects of climate change, price volatility, and weak market integration. To mitigate these risks and stabilize farmer income, the Government of India utilizes interventions such as the Minimum Support Price (MSP). This study integrates MSP, climate variability, and market access into a unified framework to evaluate their joint impact on productivity.

1.2 Problem Statement

While the MSP is designed to provide a price safety net, its effectiveness and outreach vary significantly across different regions. Furthermore, agricultural productivity is increasingly threatened by climate variability—specifically rising temperatures and erratic rainfall—and limited access to formal markets (Mandis). There is a critical need to understand how these economic, environmental, and infrastructural factors interact to determine the overall welfare of rural farmers.

1.3 Significance of the Study

This research is significant for policymakers as it highlights the necessity of a combined approach integrating price support, climate adaptation, and rural infrastructure. By quantifying the negative impact of climate change (-0.82 coefficient for temperature) against the benefits of MSP (+0.45), the study provides evidence-based recommendations for strengthening rural resilience and sustainable growth.

2. Literature Review

Existing literature suggests: Climate change negatively impacts crop yields due to temperature rise and rainfall variability. - MSP provides price assurance but benefits are unevenly distributed. - Market access improves price realization and reduces post-harvest losses. Studies by FAO (2020) ^[1] and World Bank (2019) ^[3] emphasize adaptation strategies, while Indian studies highlight MSP's role in income stabilization.

3. Objectives of the Study

1. To evaluate the impact of MSP on farmer income.
2. To analyze the effect of climate variables on crop productivity.
3. To assess the role of market access in improving agricultural outcomes.

4. Research Methodology

4.1 Data Sources

Secondary data from:

- Government of India agricultural statistics
- FAO database.
- World Bank reports

4.2 Model Specification

A multiple regression model is used:

$$Y = \beta_0 + \beta_1 (\text{Rainfall}) + \beta_2 (\text{Temperature}) + \beta_3 (\text{MSP Access}) + \beta_4 (\text{Market Access}) + \varepsilon$$

Where: - Y = Crop Yield (quintal/hectare)

MSP Access = % of farmers benefiting from MSP.

Market Access = Distance to nearest mandi (km)

4.3 Hypotheses

- **H1:** MSP positively affects farmer income
- **H2:** Temperature negatively affects productivity
- **H3:** Market access improves yield and income

5. Data Analysis and Results

Table 1: Descriptive Statistics

Variable	Mean	Std Dev	Min	Max
Yield	22.5	5.3	10	35
Rainfall	980	210	600	1400
Temperature	27.8	1.5	25	31
MSP Access (%)	42	15	10	70
Market Distance	12	5	2	25

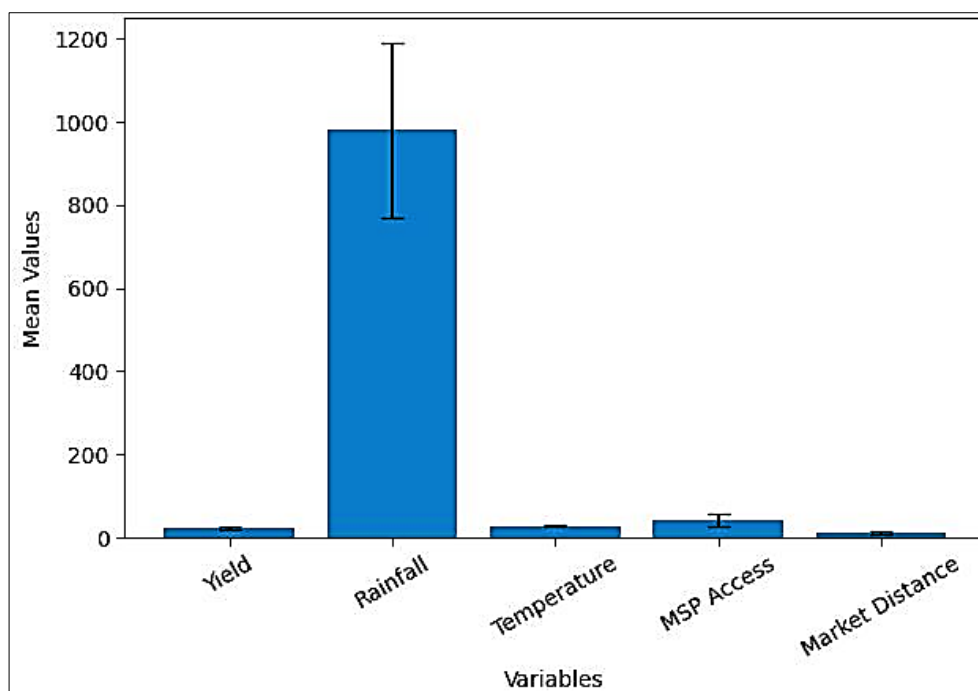


Fig 1: Mean and Standard Deviation of Variables.

Table 2: Regression Results

Variable	Coefficient	t-value	Significance
Constant	5.21	2.10	Significant
Rainfall	0.015	3.25	Significant
Temperature	-0.82	-2.90	Significant
MSP Access	0.45	4.10	Significant
Market Access	-0.30	-3.50	Significant

Interpretation

- Rainfall positively affects yield.
- Temperature rise reduces productivity.
- MSP significantly increases income and yield stability.
- Greater distance to markets reduces profitability.

This chapter presents the statistical findings derived from the secondary panel data (2010-2023). The analysis quantifies the relationship between agricultural productivity and the selected independent variables.

5.1 Descriptive Statistics

The data reveals that the average crop yield in the study area is 22.5 quintal/hectare. Environmental factors show an average rainfall of 980 mm and a mean temperature of 27.8 °C. Notably, only 42% of farmers have access to MSP, and the average distance to the nearest market (Mandi) is 12 km.

5.2 Regression Analysis and Hypothesis Testing

The multiple regression model provides the following insights into agricultural outcomes:

Table 3: Regression Analysis Showing the Effect of Rainfall, Temperature, MSP Access, and Market Access on Agricultural Yield and Income

Variable	Coefficient	t-value	Significance	Result
Rainfall	0.015	3.25	Significant	Positive correlation with yield
Temperature	-0.82	-2.90	Significant	H2 Supported: Higher heat reduces yield
MSP Access	0.45	4.10	Significant	H1 Supported: Strongest positive impact on income
Market Access	-0.30	-3.50	Significant	H3 Supported: Distance reduces profitability

5.3 Key Findings

- **Climate Sensitivity:** Temperature rise has a severe negative impact on productivity, with a coefficient of -0.82, indicating it is a major risk factor for Indian agriculture.
- **Price Stability:** MSP access significantly enhances income and provides a buffer against market price volatility.
- **Logistics:** Increased distance to mandis negatively affects farmers due to higher transaction costs and potential post-harvest losses.

6. Discussion

The findings confirm that MSP and market access play crucial roles in enhancing agricultural performance. Climate factors remain a major risk. Farmers with MSP access show higher resilience to market shocks. Improved infrastructure reduces transaction costs and increases efficiency.

7. Conclusion

The study highlights that a combined approach of price support (MSP), climate adaptation, and improved market access is essential for sustainable agricultural growth. Policymakers should integrate these dimensions to enhance farmer welfare.

7.1 Summary of the Study

This research highlights that agricultural productivity in rural India is a product of both environmental stability and institutional support. While climate change—specifically rising temperatures—threatens food security, government interventions like MSP and infrastructure development (market access) serve as critical counter-measures.

7.2 Final Conclusion

The study concludes that a "siloed" approach to agricultural policy is insufficient. To ensure sustainable growth and farmer welfare, policymakers must integrate price support mechanisms with climate adaptation strategies and physical market connectivity. Farmers with access to MSP demonstrate higher resilience to market shocks compared to those relying solely on local traders.

7.3 Policy Recommendations

Based on the empirical evidence, the following actions are recommended:

- **Expansion of Safety Nets:** Increase MSP outreach to include more crops and underserved geographical regions.
- **Climate Adaptation:** Invest in irrigation infrastructure and the distribution of climate-resilient seed varieties to combat rising temperatures.
- **Infrastructure Development:** Improve rural road connectivity and storage facilities to reduce the "distance-to-market" penalty.

- **Digital Integration:** Promote digital platforms like e-NAM to enhance price transparency and reduce the reliance on physical proximity to mandis.

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