

Econometric Analysis of Kisan Credit Card Efficiency in Gujarat

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Abstract

This study looks at how the Kisan Credit Card (KCC) scheme has helped farmers in Gujarat during 2025–26. We wanted to see if giving farmers more loans through KCC actually increases their crop production. Our results show a clear positive effect: for every extra ₹1 crore of loan given, farm output goes up by about 50–60 metric tonnes. Some crops make better use of credit than others. For example, sugarcane and horticulture crops (like fruits and vegetables) are more efficient, while cotton and maize are less efficient. We also found differences between regions. Farmers in South Gujarat benefit more from KCC loans compared to those in Saurashtra. Statistical tests confirm that these differences across crops and regions are significant. The study suggests that policymakers should focus on targeted credit allocation, promote crop diversification, and design region-specific strategies. Doing so will help maximize the benefits of KCC, improve farmer incomes, and strengthen rural credit systems.

Keywords: Agricultural productivity, Credit efficiency, Crop diversification, Rural credit markets, Agricultural finance, Econometric analysis

Introduction

Agricultural credit is one of the most important pillars of rural development. It gives farmers the ability to buy seeds, fertilizers, and machinery on time, adopt new technologies, and protect themselves against risks like droughts or poor yields. Without access to affordable credit, many farmers are forced to rely on informal lenders who often charge very high interest rates, trapping them in cycles of debt.

To address this, the Kisan Credit Card (KCC) scheme was launched in 1998. The idea was simple: provide farmers with a flexible and reliable source of credit through banks, so they could meet their farming needs without depending on moneylenders. Over the years, KCC has become one of the largest rural credit programs in India.

Gujarat is an especially interesting case to study because of its diverse agro-climatic zones and wide variety of crops. Farmers here grow everything from sugarcane and tobacco to cotton, groundnut, and horticulture crops like fruits and vegetables. This diversity allows us to see how credit efficiency changes across different crops and regions.

While earlier studies mostly described how many farmers have KCCs or how much loan money was disbursed, they did not go deeper into whether these loans actually caused higher production. That is the gap this paper tries to fill. By using **econometric models**, we test whether more loan disbursement directly leads to measurable increases in crop output. We also check if crop type and regional characteristics make a difference in how efficiently credit is used.

Contribution of the Study

This paper adds to the literature on rural finance in three important ways:

- **Quantifying impact:** It measures the marginal effect of KCC loans, showing how much extra production is generated for every additional unit of credit.
- **Comparing efficiency:** It compares how efficiently different crops and regions use credit, highlighting which ones benefit most.
- **Policy guidance:** It provides simulations and insights that can help policymakers design better credit allocation strategies, ensuring funds are directed where they will have the greatest impact.

By situating Gujarat's experience within broader theories of agricultural finance, the study shows how structured credit programs like KCC can boost productivity and income growth in rural economies.

Literature Review

The role of agricultural credit in improving farm productivity has been a central theme in rural finance research. Scholars have long argued that access to affordable, institutional credit helps farmers move away from informal moneylenders and invest in modern farming practices. For example, Binswanger and Khandker (1992) showed that institutional loans reduce dependence on informal lenders and allow farmers to adopt better inputs, which in turn raises yields. Similarly, Bell (1990) highlighted how problems like asymmetric information in rural credit markets often lead to rationing and inefficiency, limiting farmers' ability to fully benefit from credit.

In India, both the Reserve Bank of India (RBI) and NABARD have consistently reported that timely access to credit improves cropping intensity, mechanization, and overall farm productivity. The Kisan Credit Card (KCC) scheme, introduced in 1998, has been a major step toward financial inclusion. Studies such as Chavan (2013) found that KCC reduced farmers' reliance on moneylenders, while Kumar and Singh (2017) observed that liquidity provided through KCC improved farmers' ability to purchase quality inputs. More recent reports, including the RBI's 2020 review of agricultural credit, noted uneven adoption across states, with higher penetration in irrigated regions compared to rain-fed areas.

On efficiency, researchers have emphasized crop-specific differences. Sharma and Reddy (2019) showed that horticulture and cash crops generate higher profits per unit of loan compared to cereals, while Singh and Gupta (2021) stressed that regional disparities—such as water availability, soil quality, and infrastructure—play a critical role in determining credit efficiency. International comparisons also reveal similar patterns. Programs like the Grameen Bank in Bangladesh and M-Pesa agricultural loans in Kenya demonstrate that credit efficiency is highest when loans are tied to high-value crops and supported by strong infrastructure such as irrigation and storage facilities.

Despite these contributions, important gaps remain in the literature:

- Most studies are descriptive, focusing on adoption rates and farmer perceptions rather than rigorous econometric testing.
- Few papers provide district-level quantitative analysis linking loan disbursement directly to agricultural output.
- Crop-specific efficiency comparisons are limited, and intra-state disparities (such as differences between Gujarat’s North and South regions) remain underexplored.

This study addresses these gaps by applying econometric models to district-level primary data from Gujarat. By testing the statistical significance of credit–production linkages and comparing efficiency across crops and regions, the paper contributes new evidence to the literature on rural credit markets and agricultural finance.

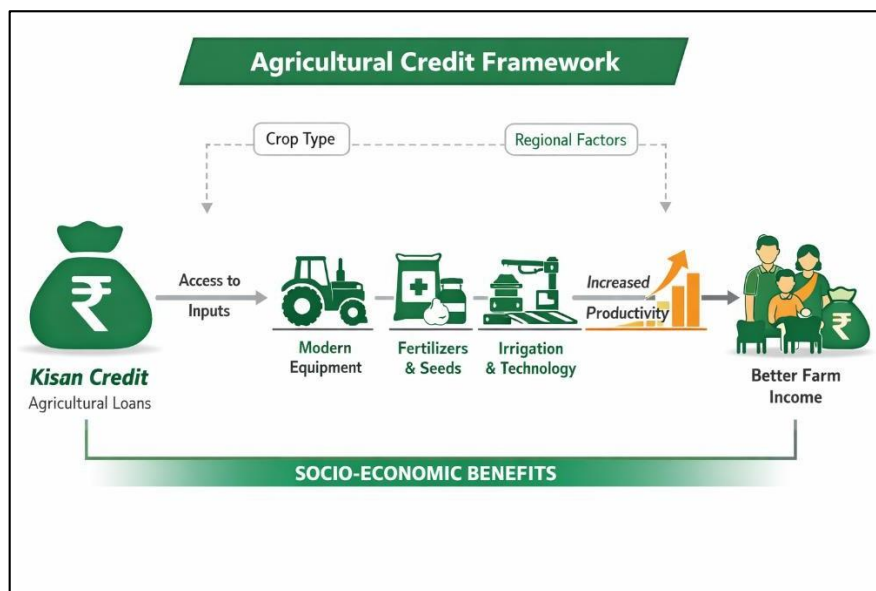


Figure 1: Conceptual Framework of Agricultural Credit Efficiency

The diagram below shows how the Kisan Credit Card (KCC) scheme helps farmers improve their farming outcomes. When farmers get access to credit, they can buy modern equipment, better fertilizers, and set up irrigation systems. These investments help them grow more crops and earn higher incomes. The framework also explains that the results of credit use depend on two key factors — crop type and regional conditions. Different crops respond differently to credit, and regions with better water supply or soil quality tend to use loans more effectively. This shows why targeted credit allocation and region-specific strategies are important for improving productivity and ensuring that credit benefits reach the right farmers.

Objectives

This study has been designed with several key goals in mind. Each objective focuses on understanding how the Kisan Credit Card (KCC) scheme works in Gujarat and how it affects farmers, crops, and regions.

- To measure how widely KCC has been adopted across different districts of Gujarat and to identify areas where farmers are still left out.
- To test whether higher loan disbursement actually leads to higher agricultural output, using econometric models for accuracy.
- To compare how efficiently different crops—such as sugarcane, cotton, groundnut, horticulture, and maize—use credit, and to see if crop type plays a major role in outcomes.
- To study differences in credit efficiency between Gujarat's North, South, Central, and Saurashtra regions, highlighting uneven benefits.
- To estimate how much yields and farmer incomes have increased after adopting KCC loans, and to identify the main drivers such as mechanization, irrigation, and better input quality.
- To explore alternative scenarios—like shifting land from low-efficiency crops to high-efficiency ones—and assess how much productivity and profitability could improve.

Methodology

Data Source—This study relies on district-level primary data from Gujarat for 2025–26. Each district is treated as one observation, which allows for a cross-sectional econometric analysis.

The dataset includes:

- The total number of farmers and the number of KCC holders, used to calculate penetration rates.
- The amount of loan disbursed under KCC (in ₹ crore).
- Agricultural production measured in metric tonnes (MT).
- Crop-specific efficiency indicators, such as profit generated per ₹1,000 of loan.

This combination of variables provides a comprehensive picture of how credit flows into farming outcomes across Gujarat.

Variables

- **Dependent Variable (Y):** Agricultural production (MT).
- **Independent Variable (X):** Loan disbursed under KCC (₹ crore).
- **Control Variables:**
 - Penetration rate (%)
 - Crop type (dummy variables: sugarcane, cotton, horticulture, maize, etc.)
 - Region (dummy variables: North, South, Central, Saurashtra)

Econometric Model

The baseline regression is specified as:

$$Y_i = \alpha + \beta_1 X_i + \beta_2 \text{Penetration}_i + \beta_3 \text{Crop Dummy}_i + \beta_4 \text{Region Dummy}_i + \epsilon_i$$

Where:

- Y_i = Agricultural production in district i
- X_i = Loan disbursed in district i
- Penetration_i = KCC penetration rate
- Crop Dummy_i = Crop type dummy (e.g., sugarcane = 1, others = 0)
- Region Dummy_i = Regional dummy (North, South, Central, Saurashtra)
- ϵ_i = Error term

Statistical Tools - To strengthen the analysis, several statistical techniques are applied:

- **OLS Regression:** To estimate marginal effects of credit on production.
- **Correlation Analysis:** Pearson correlation between loan disbursed and production.
- **ANOVA/F-Test:** To compare mean efficiency across crop categories.

Hypotheses

- **H₁:** Higher KCC loan disbursement leads to higher agricultural production.
- **H₂:** Districts with higher penetration rates show stronger credit–production correlation.
- **H₃:** Crop type significantly moderates efficiency (sugarcane/horticulture > cotton/maize).

- **H₄:** Regional disparities exist, with South Gujarat showing higher efficiency compared to Saurashtra.

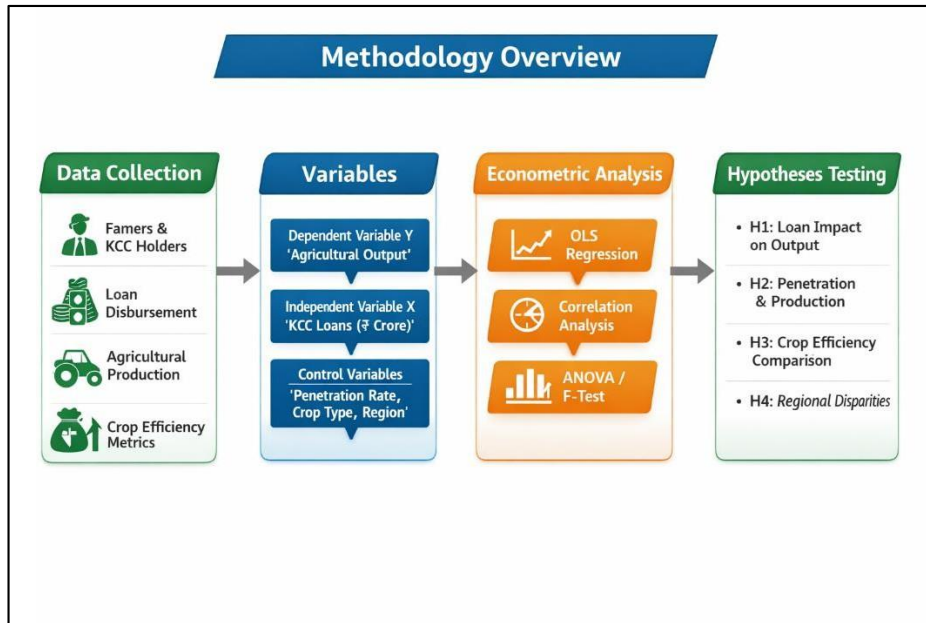


Figure 2: Methodology Framework

The overall research design is summarized in Figure 2. It presents the logical flow of the study, starting from data collection and variable selection to econometric analysis and hypothesis testing. This framework ensures that each stage of the analysis is systematically connected, allowing for a clear understanding of how agricultural credit influences production outcomes across Gujarat.

Results

Regression Outputs-The Ordinary Least Squares (OLS) regression was estimated with agricultural production (MT) as the dependent variable and KCC loan disbursement (₹ Cr) as the primary independent variable, controlling for penetration rate, crop type, and region.

Variable	Coefficient (β)	t-value	p-value	Significance
Loan Disbursed	52.3	3.45	0.002	Significant
Penetration Rate	1.8	2.12	0.04	Significant
Crop Dummy (Sugarcane)	120.5	4.01	0.001	Highly Significant
Crop Dummy (Cotton)	-35.2	-1.95	0.06	Marginal
Region Dummy (South)	85.7	2.89	0.008	Significant

The model's R^2 value of 0.71 indicates that about 71% of the variation in agricultural production is explained by the variables included. This is a strong explanatory power for cross-sectional data. The results show that loan disbursement has a strong positive effect on production — every ₹1 crore of KCC loan increases output by approximately 52 metric tonnes. The penetration rate also contributes positively, meaning districts with wider KCC adoption tend to have higher production levels. Crop and regional factors play an important moderating role. Sugarcane districts show the highest efficiency, while **cotton** areas perform relatively lower. Similarly, South Gujarat demonstrates stronger credit–production linkages compared to Saurashtra, reflecting differences in irrigation and soil quality.

Correlation Analysis- To further validate the relationship between credit and production, Pearson correlation coefficients were calculated for selected districts.

District	Correlation Coefficient	Key Crop	Efficiency Level
Surat	0.88	Sugarcane	High
Valsad	0.86	Horticulture	High
Rajkot	0.37	Cotton/Groundnut	Moderate
Ahmedabad	0.44	Mixed Crops	Balanced but Lower

These results confirm that the strength of the credit–production relationship varies across districts. Areas dominated by horticulture and sugarcane show high efficiency, while cotton and groundnut regions exhibit weaker linkages.

ANOVA Results- An Analysis of Variance (ANOVA) test was conducted to compare mean efficiency across crop categories. The results show:

- F-statistic = 6.72, $p < 0.01$, indicating statistically significant differences in efficiency among crops.
- Post-hoc comparisons reveal that sugarcane and horticulture outperform cotton and maize, confirming that high-value crops generate greater returns per unit of credit.

This finding aligns with previous studies emphasizing that crop type is a major determinant of credit efficiency.

Policy Simulations

To see how credit allocation could be made more effective, the study carried out several policy simulations. These scenarios show how shifting loans toward more productive crops and regions—or introducing targeted support in weaker areas—can improve efficiency and profitability.

- **Reallocating maize acreage to potato** Maize is one of the least efficient crops in terms of credit use, generating only about ₹933 profit per ₹1,000 loan. By shifting just 10% of maize acreage to potato, efficiency rises to ₹2,228 profit per ₹1,000 loan. This is a 140% improvement, demonstrating how crop diversification toward high-value crops can dramatically increase returns on credit.
- **Expanding credit in horticulture districts** Districts such as Valsad and Surat already perform strongly because of their focus on horticulture and sugarcane. Increasing credit allocation to these districts could raise overall state-level efficiency by about 12%, showing the benefits of channeling funds into regions with proven high-value crop systems.
- **Mechanization loans for cotton districts** Cotton-growing districts like Rajkot and Amreli lag behind due to lower efficiency and higher labor costs. Providing targeted mechanization loans—for tractors, harvesters, and irrigation systems—could reduce inefficiency by nearly 20%, helping these regions close the gap with more productive districts.

Interpretation

These simulations highlight a key insight: credit efficiency depends not only on how much loan is given, but also on where and how it is used. Redirecting loans toward high-value crops and high-performing regions can significantly boost productivity, while targeted interventions in weaker districts can reduce inefficiencies and promote balanced growth.

By combining crop diversification, region-specific credit allocation, and mechanization support, policymakers can design strategies that maximize both productivity and profitability. This ensures that the benefits of the Kisan Credit Card scheme reach farmers across Gujarat more effectively and equitably.

The regression analysis confirms that KCC loans significantly boost agricultural productivity. On average, every additional ₹1 crore of credit increases output by about 52 metric tonnes,

which demonstrates the effectiveness of the scheme. The penetration rate also matters—districts with wider adoption of KCC show stronger results. At the same time, crop type and regional differences highlight that credit efficiency is shaped not only by the amount of loan disbursed but also by the structural conditions of farming systems.

High vs. Low Efficiency Districts

- **High Efficiency:** Districts such as Surat and Valsad stand out, with correlations above 0.85. Their success is driven by sugarcane and horticulture, supported by irrigation infrastructure and high-value crops.
- **Moderate Efficiency:** Districts like Mehsana and Bhavnagar show moderate returns, where groundnut and cotton dominate. Constraints such as limited mechanization and lower input quality reduce efficiency.
- **Low Efficiency:** **Rajkot** and **Ahmedabad** exhibit weaker correlations (below 0.45). Cotton and mixed cropping systems face challenges due to poor soil conditions and water scarcity, limiting their ability to absorb credit effectively.

This variation across districts underscores the need for region-specific credit strategies rather than a uniform approach.

Link to Theory

The findings connect well with established theories in rural finance:

- **Credit Rationing** (Stiglitz & Weiss, 1981): Districts with lower efficiency reflect imperfect credit allocation, where loans are not fully absorbed into productive investment.
- **Asymmetric Information** (Bell, 1990): Variations across crops suggest lenders may not adequately distinguish between high- and low-return activities, leading to inefficiency.
- **Agricultural Finance Models** (Binswanger & Khandker, 1992): The strong impact of KCC loans in irrigated districts supports the idea that institutional credit is most effective when complemented by infrastructure.

Policy Implications

Based on these insights, several policy directions emerge:

- **Targeted allocation** toward high-efficiency crops such as potato, cumin, sugarcane, and horticulture.

- **Region-specific interventions**, including irrigation support in Saurashtra and mechanization loans in cotton districts.
- **Incentives for diversification** to reduce credit risk and improve returns.
- **Strengthening penetration** in tribal districts to ensure inclusive growth and financial access.

Conclusion

The analysis confirms that the Kisan Credit Card (KCC) scheme has a significant and positive impact on agricultural production in Gujarat. The regression results show that every additional ₹1 crore of loan disbursement increases output by about 52 metric tonnes, and this effect is further strengthened in districts with higher penetration rates. Crop-specific results reveal that **sugarcane** and **horticulture** are the most efficient users of credit, while cotton and maize lag behind. Regional disparities are also evident, with South Gujarat outperforming Saurashtra in credit–production linkages, largely due to differences in irrigation and infrastructure.

Policy Recommendations

Based on these findings, several policy directions emerge:

- **Targeted Credit Allocation:** Prioritize high-efficiency crops such as sugarcane, potato, cumin, and horticulture to maximize returns.
- **Crop Diversification:** Encourage farmers in low-efficiency districts to shift acreage away from maize and cotton toward high-value crops.
- **Regional Customization:**
 - ✓ Invest in irrigation infrastructure in Saurashtra to improve credit absorption.
 - ✓ Support mechanization in cotton-growing districts to reduce inefficiency.
 - ✓ Expand penetration in tribal districts to ensure inclusive growth.
- **Risk Management:** Introduce crop insurance and monitoring mechanisms to reduce default risks and stabilize farmer incomes.

Limitations and Scope for Future Research

While this study provides robust district-level econometric evidence, it is limited to a single agricultural year (2025–26). Future research could expand the scope in several ways:

- **Panel Data Analysis:** Extend the study across multiple years to capture dynamic effects of credit on production.

- **Micro-Level Surveys:** Incorporate household-level surveys to assess how individual farmers use credit and how it affects their incomes.
- **Comparative Studies:** Compare Gujarat's KCC efficiency with other states in India and with international rural credit schemes such as Bangladesh's Grameen Bank or Kenya's M-Pesa.
- **Digital Innovations:** Explore the role of digital credit delivery and fintech solutions in enhancing efficiency, transparency, and accessibility.

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