

Economic Analysis of Income Instability among Cotton and Soybean Farmers in Western Vidarbha: A Systematic Review of Literature (Review Paper)

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Abstract—Agriculture plays a central role in India's economy by supporting food security, employment generation, and rural livelihoods. In Western Vidarbha, especially in Akola and Washim districts, cotton and soybean are among the most important commercial crops. However, farmers cultivating these crops often experience unstable incomes because of price fluctuations, increasing input costs, climate uncertainty, limited irrigation, market inefficiencies, and policy-related challenges. A clear understanding of these issues is important for improving agricultural sustainability and farmer welfare.

This study presents a systematic review of literature on cotton and soybean production, agricultural price volatility, farmer income instability, agricultural marketing, and econometric approaches in agricultural economics. Studies published between 2005 and 2025 were reviewed from peer-reviewed journals, government reports, international organization publications, and academic databases. Particular attention was given to studies using ARIMA, ARCH, and GARCH models for price forecasting and volatility analysis.

The review shows that price volatility is one of the main causes of income instability among farmers. Although existing research has examined agricultural marketing, production economics, and price behavior, district-level evidence for Western Vidarbha is still limited. Very few studies have jointly analyzed cotton and soybean farmers' income instability using advanced econometric methods. The review therefore identifies important research gaps and emphasizes the need for integrated empirical studies in Akola and Washim districts.

The study concludes that better market infrastructure, stronger Farmer Producer Organizations, real-time market information systems, wider crop insurance coverage, and improved price forecasting techniques can help reduce income instability. The findings provide a theoretical and methodological foundation for future

empirical research and offer useful insights for policymakers, researchers, and agricultural institutions.

Index Terms—Agricultural Economics; ARIMA Model; Cotton; Farmer Income Instability; GARCH Model; Price Volatility; Soybean; Systematic Literature Review; Western Vidarbha.

I. INTRODUCTION

Agriculture remains one of the most important sectors of the Indian economy, contributing to national income, employment generation, food security, and rural development. A large share of the rural population continues to depend on agriculture and allied activities for livelihood, which makes the performance of this sector directly linked to economic growth and social welfare.

In Maharashtra, particularly in Western Vidarbha, cotton and soybean are the dominant commercial crops. The districts of Akola and Washim offer favorable agro-climatic conditions for these crops, making them important to the regional agricultural economy. Cotton is a major fibre crop with industrial and export significance, while soybean is a key oilseed crop that supports edible oil production, animal feed industries, and trade.

Despite their economic importance, cotton and soybean farmers often face unstable incomes. Their earnings are affected by fluctuating market prices, rising input costs, unpredictable rainfall, climate change, pest and disease pressure, limited irrigation, restricted access to institutional credit, and weak marketing systems. During harvest periods, price

falls often force farmers to sell at unfavourable rates, reducing profitability and increasing financial vulnerability.

Agricultural price volatility has become a major concern for researchers and policymakers worldwide. Global trade, exchange rate changes, energy prices, and shifting demand-supply conditions all affect commodity markets. Therefore, understanding price behavior is essential for creating policies that improve farmer income and support sustainable agricultural development.

In recent years, researchers have increasingly used econometric techniques such as ARIMA for price forecasting and GARCH for volatility estimation. These models have been applied to many agricultural commodities, but their use in studying cotton and soybean markets in Western Vidarbha, especially at the district level, remains limited.

The existing literature mostly covers marketing systems, crop production, price forecasting, policy interventions, and rural development. While cotton and soybean have been studied separately, few studies have examined how price volatility affects income instability for both crops together. District-specific evidence from Akola and Washim is also scarce, showing the need for a comprehensive review of the existing research

This review paper therefore examines national and international literature on agricultural price volatility, farmer income instability, cotton and soybean economics, and econometric modeling. By synthesizing this research, the study aims to identify major themes, methodological approaches, research gaps, and future research opportunities. The findings are expected to provide a strong foundation for future empirical research on income instability among cotton and soybean farmers in Western Vidarbha.

The significance of this review lies in its integrated approach to understanding the relationship between agricultural price behavior and farmers' income. The study also highlights the relevance of advanced econometric models, such as ARIMA and GARCH, for analyzing agricultural markets and supporting evidence-based policymaking. The review is expected to contribute to the literature on agricultural economics by providing a comprehensive assessment of previous research and identifying areas requiring further investigation.

Objectives of the Review

1. To critically review national and international literature on cotton and soybean farmers' income instability.
2. To examine studies related to agricultural price volatility and market behavior.
3. To review the application of ARIMA and GARCH models in agricultural economics.
4. To identify the major research gaps in the existing literature.
5. To suggest future research directions for empirical studies in Western Vidarbha..

II. RESEARCH METHODOLOGY

A. Research Design

The present study adopts a Systematic Literature Review (SLR) approach to critically evaluate and synthesize published research related to income instability among cotton and soybean farmers. A systematic review follows a structured, transparent, and reproducible process for identifying, selecting, evaluating, and interpreting existing studies. Unlike a narrative review, the SLR approach minimizes selection bias by using predefined inclusion and exclusion criteria and a comprehensive search strategy.

The review focuses on studies examining agricultural price volatility, farmer income instability, agricultural marketing, production economics, government interventions, and econometric applications in agriculture.

B. Nature of the Study

The study is:

- Descriptive in nature.
- Analytical in approach.
- Qualitative and review-based.
- Exploratory in identifying research gaps.

The review does not involve primary data collection. Instead, it analyses existing published studies to understand current knowledge, methodological developments, and future research opportunities.

C. Sources of Data

The study is based entirely on secondary data collected from reliable national and international sources.

National Sources

- Ministry of Agriculture and Farmers' Welfare, Government of India.
- Commission for Agricultural Costs and Prices (CACP).
- NABARD.
- Reserve Bank of India (RBI).
- Directorate of Economics and Statistics.
- Government of Maharashtra Economic Survey.
- Agricultural Produce Market Committees (APMCs).
- AGMARKNET.

International Sources

- Food and Agriculture Organization (FAO).
- World Bank.
- Organisation for Economic Co-operation and Development (OECD).
- International Cotton Advisory Committee (ICAC).

Academic Databases

- Google Scholar.
- Scopus.
- Web of Science.
- AGRIS.
- JSTOR.

D. Literature Search Strategy

Relevant literature was identified using a combination of keywords related to the objectives of the study. The search strategy included the following keywords:

- Cotton price volatility.
- Soybean price volatility.
- Farmer income instability.
- Agricultural economics.
- Agricultural marketing.
- Cotton farmers.
- Soybean farmers.
- ARIMA model.
- GARCH model.
- Agricultural price forecasting.
- Western Vidarbha agriculture.
- Maharashtra agriculture.

Boolean operators such as AND, OR, and NOT were used to refine the search and improve the relevance of retrieved studies.

E. Inclusion Criteria

The following studies were included in the review:

- Peer-reviewed journal articles.
- Review papers.
- Government reports.
- International organization reports.
- Books and book chapters related to agricultural economics.
- Studies published between 2005 and 2025.
- Research focusing on cotton, soybean, agricultural price behavior, farmer income, and econometric modelling.
- Publications written in English.

F. Exclusion Criteria

The following documents were excluded:

- Newspaper articles.
- Magazine reports.
- Non-peer-reviewed publications.
- Conference abstracts without full papers.
- Duplicate publications.
- Studies unrelated to agricultural economics or farmer income.

G. Data Extraction Procedure

For each selected publication, the following information was systematically extracted:

- Author(s).
- Year of publication.
- Country or study area.
- Research objectives.
- Data source.
- Research methodology.
- Statistical techniques.
- Major findings.
- Research limitations.
- Research gap.

This information facilitated comparison across studies and helped identify trends and gaps in the literature.

H. Data Analysis Technique

The collected literature was analysed using the following techniques:

- Descriptive analysis.
- Comparative analysis.
- Content analysis.
- Thematic analysis.

- Research gap analysis.

Special attention was given to studies employing ARIMA for agricultural price forecasting and GARCH for volatility estimation, as these econometric models are highly relevant to the proposed research.

I. Reliability of the Review

To ensure the reliability and credibility of the review:

- Only authentic and recognized academic sources were consulted.
- Priority was given to peer-reviewed journal articles.
- Government and international reports were used for supporting evidence.
- Multiple databases were searched to minimize publication bias.

J. Limitations of the Methodology

The methodology has certain limitations:

- The review is based exclusively on secondary data.
- The quality of conclusions depends on the quality of previously published studies.
- No primary survey or empirical estimation has been undertaken in this review paper.
- Some recent studies may not have been available at the time of the review.

K. Chapter Summary

The Research Methodology Adopted In This Study Provides A Systematic And Transparent Framework For Reviewing Existing Literature On Income Instability Among Cotton And Soybean Farmers. By Integrating Evidence From National And International Studies, The Methodology Establishes A Strong Foundation For Identifying Research Gaps And Guiding Future Empirical Investigations. The Use Of Structured Literature Selection Criteria And Comprehensive Analytical Techniques Enhances The Academic Rigor And Reliability Of The Review.

III. NATIONAL LITERATURE REVIEW

A. Introduction

Agriculture plays a significant role in India's socio-economic development by providing employment and livelihood to a large proportion of the rural population. Cotton and soybean are among the most important commercial crops cultivated in

Maharashtra, particularly in the Western Vidarbha region. Over the past two decades, numerous studies have examined agricultural marketing, price behavior, production economics, farmer income, and government interventions. However, district-level evidence on income instability among cotton and soybean farmers remains limited.

This section critically reviews major Indian studies relevant to the objectives of the present review.

B. Studies on Agricultural Marketing

Acharya and Agarwal (2011) highlighted that agricultural marketing is one of the key determinants of farmers' income. Their study emphasized that the presence of multiple intermediaries, inadequate storage facilities, poor transportation infrastructure, and limited access to market information reduce farmers' profitability. They recommended strengthening market information systems, improving rural infrastructure, and encouraging direct marketing channels to increase farmers' income.

Similarly, several studies on Agricultural Produce Market Committees (APMCs) reported that marketing inefficiencies increase transaction costs and expose farmers to distress sales during the harvesting season.

C. Studies on Farmers' Income

Chand (2017) analysed the factors influencing farmers' income in India and concluded that increasing agricultural productivity alone is insufficient for achieving sustainable income growth. The study recommended diversification of farming systems, better irrigation facilities, value addition, improved marketing infrastructure, and policy support as essential strategies for enhancing farmers' income. Subsequent studies also reported that income instability is influenced not only by production but also by fluctuating market prices, climatic risks, and increasing cultivation costs.

D. Studies on Cotton Production

Research conducted on cotton cultivation in Maharashtra indicates that cotton remains one of the most profitable yet highly risky commercial crops. Major determinants affecting cotton farmers include:

- Rainfall variability.
- Pest infestation.
- Rising input prices.

- Labour shortages.
- Market price fluctuations.

Several studies reported that although improved seed varieties have enhanced productivity, increasing production costs and unstable market prices continue to reduce net farm income.

E. Studies on Soybean Production

Soybean has emerged as one of India's leading oilseed crops and contributes significantly to rural income. Studies conducted in Maharashtra indicate that soybean cultivation has expanded rapidly due to favourable market demand and relatively lower production costs.

Researchers observed that soybean prices are influenced by:

- Domestic production.
- International market demand.
- Export policies.
- Processing industries.
- Seasonal arrivals.

Price fluctuations during harvesting periods often reduce farmers' profitability despite higher production levels.

F. Studies on Agricultural Price Volatility

Several Indian researchers have examined agricultural price behaviour using time-series techniques. Their findings indicate that:

- Agricultural commodity prices exhibit significant seasonal fluctuations.
- Supply shocks and market arrivals influence price movements.
- Government procurement policies affect market stability.

- International commodity prices increasingly influence domestic agricultural markets.

These studies conclude that effective price forecasting systems can help farmers make better production and marketing decisions.

G. Studies on Agricultural Marketing Reforms

Research on agricultural marketing reforms highlights the importance of:

- Electronic National Agriculture Market (e-NAM).
- Farmer Producer Organizations (FPOs).
- Warehouse receipt systems.
- Market information services.
- Digital agriculture.

Most studies conclude that improved market access and better price dissemination systems enhance farmers' bargaining power and reduce marketing inefficiencies.

H. Econometric Studies in Agricultural Economics

Indian agricultural economists have increasingly adopted modern econometric techniques to analyse agricultural markets.

The most commonly used models include:

- Multiple Regression Analysis.
- Time Series Analysis
- ARIMA Model.
- ARCH Model.
- GARCH Model.
- Cointegration Analysis.

Among these models, ARIMA has been widely used for forecasting agricultural commodity prices, while GARCH has been used to measure volatility and price instability. However, district-level application of these methods to cotton and soybean markets remains limited.

I. Research Gap

The review of national literature shows that although several studies have addressed marketing, production, and price behavior in agriculture, few have directly examined the combined income instability of cotton and soybean farmers in Western Vidarbha. There is also a shortage of district-level empirical work from Akola and Washim that integrates market behavior, price volatility, and farmers' income in a single framework.

J. Chapter Summary

The national literature shows that farmers' income instability is influenced by a combination of market inefficiencies, production risks, and price fluctuations. It also demonstrates the growing relevance of econometric models in agricultural economics. However, the existing evidence still leaves a clear gap for localized research on cotton and soybean farmers in Western Vidarbha.

IV. RESEARCH GAP AND SYNTHESIS

A. Research Gap

The literature reviewed in the earlier sections shows that agricultural income instability has been widely

studied in India and abroad. Researchers have examined marketing inefficiencies, production risks, climatic uncertainty, and price volatility in both cotton and soybean markets. However, most of this research is either broad in scope or focused on national, state, or market-level data rather than district-level evidence.

A major gap in the existing literature is the limited number of studies that jointly analyze cotton and soybean farmers' income instability. In addition, very few works have concentrated specifically on Western Vidarbha, particularly the Akola and Washim districts, where these crops are highly important. Although some studies have examined soybean economics in parts of Western Vidarbha, the combined effect of price volatility, marketing conditions, and income instability for both crops remains underexplored.

Another gap concerns methodology. While ARIMA and GARCH models have been used extensively in agricultural price studies, their application to cotton and soybean income instability at the district level is still limited. Most available research discusses price behavior in general terms rather than linking volatility directly to farmer income outcomes. This creates a need for more integrated empirical analysis using advanced time-series techniques.

B. Synthesis of Findings

The review indicates that income instability among cotton and soybean farmers is shaped by both production-side and market-side factors. Production risks such as rainfall uncertainty, pest attacks, and rising input costs interact with market forces such as seasonal arrivals, price fluctuations, and weak bargaining power. These factors together reduce income certainty and increase vulnerability for farmers in cotton- and soybean-growing regions.

The literature also suggests that better market systems, stronger farmer organizations, and reliable price forecasting can improve decision-making and reduce exposure to distress sales. At the same time, the evidence shows that policy interventions have had mixed results unless they are supported by strong implementation, local infrastructure, and timely information access.

C. Implications for the Present Study

The identified gaps justify the need for a focused study on cotton and soybean farmers in Western

Vidarbha. A district-level investigation can provide more precise evidence on how price volatility and marketing conditions affect income stability. Such a study can also contribute to the existing literature by connecting crop economics, market behavior, and econometric forecasting within a single analytical framework.

The present review therefore serves as a foundation for future empirical work in Akola and Washim. It supports the use of structured volatility analysis and localized agricultural data to better understand the challenges faced by farmers in the region.

D. Chapter Conclusion

In summary, the available literature confirms that income instability in agriculture is a multidimensional problem influenced by production risk, market inefficiency, and price volatility. Yet there remains a clear shortage of research focused specifically on cotton and soybean farmers in Western Vidarbha. Addressing this gap will help strengthen policy design, improve market responses, and support more stable rural incomes.

V. FINDINGS, CONCLUSION, AND RECOMMENDATIONS

A. Major Findings

The review shows that income instability among cotton and soybean farmers is driven by a combination of market, production, and policy-related factors. Price volatility emerges as one of the most significant causes of uncertain farm income, especially when farmers are forced to sell soon after harvest. Rising input costs, weather variability, pest incidence, limited irrigation, and weak access to institutional support further intensify the problem.

The literature also indicates that agricultural marketing systems play a major role in shaping income outcomes. Inefficient market channels, low storage capacity, poor price information, and dependence on intermediaries reduce the share of the final market price received by farmers. At the same time, the evidence suggests that policy tools such as Farmer Producer Organizations, crop insurance, and market reforms can reduce some of the risk, though their success depends on local implementation and farmer participation.

Another important finding is that ARIMA and GARCH models have been widely used in agricultural economics to study price trends and volatility. These methods are useful for forecasting and risk measurement, but the literature reveals limited district-level application for cotton and soybean farmers in Western Vidarbha. This confirms the need for more localized empirical work that connects price volatility with farmer income behavior.

B. Conclusion

The review concludes that income instability among cotton and soybean farmers is a complex issue shaped by market volatility, production uncertainty, and structural weaknesses in agricultural marketing. Although the literature offers valuable insights into agricultural pricing, productivity, and marketing reforms, it does not sufficiently address the specific conditions of Akola and Washim districts.

The evidence strongly supports the need for integrated research combining crop economics, price forecasting, and income analysis. Such work will help generate more region-specific findings and provide a stronger basis for policy design. Overall, the review confirms that better market systems, more effective risk management, and improved access to timely information are essential for stabilizing farm incomes in Western Vidarbha.

C. Recommendations

- Strengthen agricultural market infrastructure, including storage, transport, and local procurement facilities.
- Expand and support Farmer Producer Organizations to improve collective bargaining and reduce dependence on intermediaries.
- Improve access to real-time market information so that farmers can make better selling and production decisions.

Broaden crop insurance coverage and ensure quicker claim settlement to reduce income shocks.

- Promote the use of forecasting tools such as ARIMA and GARCH for monitoring price movements in major crops.
- Encourage district-level empirical studies on cotton and soybean income instability in Western Vidarbha.

- Support policy initiatives that reduce seasonal distress sales and improve price realization for farmers.

D. Final Remark

Taken together, the findings suggest that income stability for cotton and soybean farmers cannot be achieved through production measures alone. It requires a coordinated strategy that addresses pricing, marketing, risk management, and institutional support. This makes Western Vidarbha an important setting for future research and policy attention.

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