

Economic Impact of Geographical Indication on Basmati Rice Farmers in India

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Preface

Basmati rice occupies a central place in India's agricultural landscape, particularly across the Indo-Gangetic plains of Punjab, Haryana, western Uttar Pradesh, Uttarakhand, Himachal Pradesh and Jammu & Kashmir, where its cultivation underpins rural economies, cultural heritage, and the livelihoods of millions. The crop not only shapes the socio-economic condition of the region but also contributes substantially to India's agri-export potential and global market footprint, accounting for the single largest share of the country's agricultural export earnings. Yet, the sector today stands at a critical juncture. Contested claims over the Basmati name in international jurisdictions, declining unit value realization in export markets, persistent gaps in traceability and enforcement, and competing demands for revision of the demarcated growing area pose mounting challenges to the long-term profitability and resilience of Basmati growers. In such a dynamic environment, a rigorous understanding of whether geographical indication (GI) protection translates into tangible economic gains at the farm gate becomes essential for making informed, forward-looking policies.

This policy paper presents a comprehensive and analytically robust assessment of the economic impact of GI on Basmati rice farmers in India. The insights generated from the study offers valuable guidance for strengthening GI governance, anchoring boundary delineation in scientific evidence, deepening farm-to-export traceability, and ensuring that growers in the demarcated regions are better equipped to capture a larger share of the value their produce commands abroad. This policy paper will contribute meaningfully to evidence-based decision-making and serve as a useful resource for policymakers, researchers, and all stakeholders committed to advancing India's geographical indication framework and improving the livelihoods of farming communities across the Basmati belt. We also thank reviewer of the paper Pratap Singh BIRTHAL, Ex-Director, ICAR-NIAP and Distinguished Fellow, Research and Information System for Developing Countries (RIS), New Delhi, for his comments and suggestions. The authors acknowledge with gratitude the financial support and institutional facilitation provided by ICAR-NIAP, which enabled the successful completion of this research.

Authors

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Executive Summary

Over the past three decades, Indian agriculture has progressively shifted from a production-centric paradigm towards one that places equal emphasis on value realization at the farm gate. Within this evolving landscape, the protection of region-specific agricultural products through Geographical Indications (GIs) has emerged as a promising policy instrument for differentiating produce, capturing price premiums in domestic and international markets, and translating these gains into higher farm incomes. GIs are a form of intellectual property that link the quality or distinctive character of a product to its place of origin. Through this collective and territorially embedded framework, they convert geography itself into a competitive market advantage. Globally, GIs have been recognized as an effective tool for value creation, and farmers' welfare.

India enacted the Geographical Indications of Goods (Registration and Protection) Act in 1999, which came into force on 15 September 2003. As on 31 March 2026, 724 GIs had been registered, of which 31.4 percent are agricultural products. Among agricultural GIs, Basmati rice occupies a position of singular economic and cultural significance, having been cultivated for over two centuries in the fertile plains of Punjab, Haryana, Himachal Pradesh, Uttarakhand and parts of western Uttar Pradesh and Jammu & Kashmir. The Basmati is not represent merely a variety; it is a product whose sensory characteristics, elongated slender grains, distinctive aroma, and exceptional linear elongation on cooking are inseparable from the soils, hydrology, and cool grain-filling temperatures of the Indo-Gangetic Plains.

Notwithstanding the institutional importance attached to GI protection in India, empirical evidence on whether such protection actually translates into higher prices and net incomes for farmers is scarce. This paper addresses this gap by drawing on a primary survey of 600 Basmati rice farm households, equally sampled from within and outside the GI-demarcated zone. It employs a Geographical Regression Discontinuity (GRD) design, using the GI boundary as the identification threshold, to estimate the causal impact of GI status on farm-gate prices and net farm income. The key findings of this study are as follows:

The basmati rice production system has undergone a significant transformation: The area under its cultivation expanded from 1,410 thousand

hectares in 2010 to 2,135 thousand hectares in 2023, while production rose from 5,715 thousand tonnes to 9,846 thousand tonnes. The variety Pusa Basmati 1121 accounts for more than half of the area, followed by PB 1718, PB 1885, PB 1509, and PB 1847. India continues to dominate the global Basmati market, with exports of 6,065 thousand tonnes valued at US\$ 5,944 million during 2024–25, contributing 11.4 percent the country's total agricultural export earnings.

India's GIs framework evolved through international obligations and domestic policy responses: India's GI framework evolved through international agreements such as the TRIPS Agreement (1995), while domestic reforms were driven by the 1997 RiceTec Basmati dispute. This led to the enactment of the Geographical Indications of Goods (Registration and Protection) Act, 1999, implemented in 2003 with the establishment of the GI Registry in Chennai. Darjeeling Tea became India's first registered GI in 2004, followed by the GI registration of Basmati rice in 2016 after prolonged examination. Recent initiatives such as the Basmati.Net traceability platform, the EU PGI application, and FSSAI quality regulations have further strengthened the GI ecosystem. By March 2026, India had 724 GI registrations, with agricultural products accounting for 31.4 percent.

GI certification provides a modest price premium to basmati rice farmers: GI registration raises farm-gate prices significantly. The bias corrected and estimates show that that GI-status farms receive 8 percent higher price than comparable non-GI farms.

GI status translates into higher net farm income: The convergence of the price and income effects demonstrates that the GI premium flows through to farm-level profitability and is not absorbed entirely along the value chain. The GRD regression estimate shows that GI-eligible farms earn Rs. 3,792 per acre more than non-GI farms.

The specific policy suggestions emerging from this study are as follows:

Review and update the existing basmati GI demarcated area: Since farmers cultivating basmati rice within the GI-demarcated area receive a price premium, there is a strong case for a calibrated, evidence-based review of the existing GI boundaries. Regions where authentic basmati cultivation is already well established could be considered for inclusion, subject to rigorous scientific validation of their agro-climatic suitability and of the distinct quality traits associated with basmati. Such review also has direct implications for exports. Under the current traceability system, only basmati grown within the GI-demarcated area is eligible for export as GI basmati; produce from outside the boundary cannot enter this export channel. Hence, a scientifically

validated expansion of the GI boundary would enlarge the exportable surplus of basmati besides increasing eligibility of farmers to participate in GI- based production and export markets.

Anchor GI area expansion based on rigorous scientific evidence: To preserve the authenticity and economic value of the GI, the expansion and protection of the basmati GI demarcated area should be based on rigorous scientific evidence, ensuring that any expansion strengthens rather than dilutes the basmati brand. Basmati's distinctive aroma and quality are shaped by the interaction of environmental conditions, soil properties, genetic factors, and cultivation practices rather than by seed alone. The Texmati experience, where Indian basmati germplasm failed to reproduce the same quality attributes under different growing conditions, highlights the importance of geographical and agro-ecological factors in creating the GI premium. Accordingly, the inclusion of new regions and the defence of India's GI in international forums should be based on robust scientific evidence demonstrating that candidate areas possess the necessary conditions to produce authentic basmati, thereby preserving the integrity and value of the GI.

Strengthen traceability for GI Integrity and expansion: As traceability connects producers to the GI premium and underpins regulatory compliance and international market access, any expansion of the GI registry should be accompanied by investments in digital farm-to-export tracking and verification systems. Upgrading these mechanisms enhance transparency, strengthen consumer confidence, improve enforcement, and safeguard the authenticity and reputation of Indian basmati in global markets.

Strengthen India's international GI protection strategy: Strengthen India's international protection of GI by integrating legal, scientific, and diplomatic efforts to safeguard the authenticity and heritage of Indian basmati in global markets. As competing territorial claims and the commercial value of the basmati name continue to grow, effective protection requires a coordinated approach that combines robust scientific evidence, strong intellectual property enforcement, and proactive trade diplomacy. A well-integrated strategy will enhance India's ability to defend the basmati GI in international jurisdictions, counter misleading claims, and preserve the economic and cultural value of Indian basmati for producers and exporters.

Invest in R&D to strengthen basmati GI governance: Invest in multidisciplinary scientific research on the determinants of basmati quality, including agro-climatic conditions, soil characteristics, genetic resources, and crop management practices. A stronger scientific evidence base will improve the governance of the GI by supporting decisions on area delineation and revision, strengthening international legal protection, and enhancing the credibility of

India's claims in global markets. Continuous research will also facilitate the development of improved production practices without compromising the unique characteristics of authentic basmati.

Promote global branding and market development for Indian basmati:

Strengthen the global positioning of Indian basmati through targeted branding initiatives, international marketing campaigns, participation in trade fairs, and strategic trade promotion activities. A coordinated branding strategy that highlights the unique quality, heritage, and geographical identity of Indian basmati can expand market access, reinforce its premium status, and increase export earnings while differentiating Indian basmati from competing products.

Strengthen institutional capacity across the basmati value chain: Enhance institutional support across the basmati value chain by promoting farmer producer organisations, strengthening extension services, improving quality seed systems, and encouraging the adoption of advanced production and post-harvest technologies. Building institutional capacity will improve productivity, quality assurance, and market integration while enabling farmers to capture a larger share of the economic benefits associated with the basmati GI.



Enhancing farmers' incomes and ensuring a consistent supply of high-quality agricultural products remains key priorities in India. With smallholder farmers forming the backbone of agriculture, the challenge is not only to increase agricultural productivity but also to improve value realization at the farm level. The country's vast and diverse agro-climatic conditions and significant regional disparities in resource endowments necessitate location-specific strategies to effectively improve farm income and rural livelihoods. Therefore, harnessing unique local resources and promoting region-specific agricultural products has emerged as an important approach to strengthen rural economies, enhance market competitiveness, raise farmers' income. In this context, Geographical indications (GIs) are recognised as a promising tool for value creation and producer welfare (Guareschi et al., 2023).

A GI is a form of intellectual property that certifies a product's origin and attributes its distinctive quality or character to a specific geographical environment. Article 22(1) of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) defines GIs as "indications which identify a good as originating in the territory of a member, or a region or locality in that territory, where a given quality, reputation or other characteristic of the good is essentially attributable to its geographic origin" (WIPO, 2023). GIs are thus territorially embedded and collectively governed arrangements that link products to places through shared production standards and collective reputation (Blakeney et al., 2020), transforming geography itself into a competitive market advantage (Marie-Vivien and Biénabe, 2017).

The economic case for GIs rests on two mechanisms. First, GIs reduce information asymmetry: consumers cannot directly verify the quality attributes of agricultural products, and an origin label allows credible differentiation from ordinary goods, enabling producers to command higher prices (Zhang et al., 2024a, 2024b). Second, GIs create a collective branding effect that extends industrial linkages and generates employment along the value chain, thereby raising farm incomes. Empirically, GI registration has been found to raise agricultural exports by improving perceived quality and displacing counterfeits (Bansal and Singh, 2024), to enhance rural incomes through product differentiation and stronger producer bargaining power (Yin et al., 2024), to shift cropping patterns towards GI-tagged crops as producers

respond to improved price signals (Bansal and Singh, 2024), and to strengthen the resilience of agricultural systems (Liao et al., 2025). Globally, GIs are also recognised as instruments of rural development and poverty alleviation (Iraizoz et al., 2011; Nizam and Tatari, 2022). These gains are, however, contingent on enabling conditions such as effective intellectual property enforcement, digital infrastructure and efficient judicial institutions (Wang et al., 2025), and short-run compliance costs may initially suppress farm-level returns (Dogan, 2024).

India, as a member of the World Trade Organization (WTO), enacted the Geographical Indications of Goods (Registration and Protection) Act, 1999, which into effect from 15th September 2003. As on 31st March 2026, 724 GIs were registered, of which 31.4 percent were agricultural (IPO, 2026). Among agricultural GIs, Basmati rice commands a position of singular economic and cultural significance. In 2016, basmati rice received formal GI registration, cultivated for over two centuries in the fertile plains of Punjab, Haryana, Delhi, Himachal Pradesh, Uttarakhand, and designated parts of western Uttar Pradesh and Jammu & Kashmir. Basmati is not merely a variety of rice, it is a product that embodies a distinct agro-ecological identity shaped by the soils, hydrology, and cool grain-filling temperatures of the Indo-Gangetic Plains. The sensory characteristics that define authentic Basmati are its elongated slender grains, characteristic fragrance, and exceptional linear elongation on cooking with minimal breadth-wise swelling. Further, to ensure authenticity of Basmati rice reaching the consumer in India or abroad, APEDA has developed a web-based traceability system known as “Basmati.Net”.

In India, a few limited studies have attempted to assess the impact of agricultural GIs on farmers’ income. Existing studies are largely skewed towards trade, institutional, and legal dimensions of GIs (Sen, 2010; Das, 2010; Chattopadhyay, 2012). Jena and Grote (2012) analyze income differences in traditional Basmati cultivation using primary data, yet their study does not isolate the specific impact of GI registration nor establish a counterfactual framework. Similarly, studies on Darjeeling tea suggest that GI protection contributes to price premiums and improved market positioning, but the transmission of these gains to primary producers remains uneven and weakly quantified (Das, 2010). Prasanna and Reddy (2025) evaluate the export performance of Basmati rice and find heterogeneous and sometimes limited post-GI effects, without linking these outcomes to farm-level income. Thus, a significant research gap persists in understanding the causal impact of GI protection on farmers’ income.

This study examines an important question: Do agricultural GIs benefit farmers, or do they remain largely symbolic designations? The growing

body of empirical evidence suggests that GIs generate significant and wide-ranging effects across multiple dimensions of agricultural performance. GI registration has been consistently found to increase agricultural export by enhancing the perceived quality of products, removing counterfeits from markets, and enabling better marketing in international markets (Bansal and Singh, 2024). At the farm level, GI certification contributes to agricultural value chain and enhances rural income, by reducing information asymmetry, product differentiation, and increased bargaining power for producers (Yin et al., 2024). GIs also play a pivotal role in farmers' production decisions, with GI-tagged crops gradually expanding their share of total cultivated area as producers respond to improved price signals and market prospects (Bansal and Singh, 2024). Thus, GI products contribute to agricultural economic resilience by strengthening risk resistance capacity, adaptive adjustment capability, and green transformation capacity of agricultural systems (Liao et al., 2025). However, the impacts of GIs are contingent upon enabling conditions including robust intellectual property protection, digital infrastructure development, and efficient judicial institutions (Wang et al., 2025), while short-run compliance costs and yield constraints may initially suppress farm-level returns under GI systems (Dogan, 2024).

The rationale for this investigation rests on three policy imperatives. First, there is a need to critically assess whether India's Basmati GI has delivered tangible economic benefits to farmers, who are its intended beneficiaries. Second, despite substantial institutional efforts the extent to which these interventions translate into higher prices and improved farm incomes remains unclear. In the absence of rigorous farm-level evidence, it is difficult to ascertain whether the GI premium is effectively reaching producers or being absorbed along the value chain. Third, empirical evaluation makes the case for developing India's broader GI framework and contributes to evidence-based policymaking.

Using primary survey, this study addresses these gaps by empirically evaluating the economic impact of agricultural GI certification on farmers. Specifically, it examines the effect of GI status on net income and price realization among Indian Basmati rice farmers. The impact assessment is carried out using a Geographical Regression Discontinuity (GRD) framework.



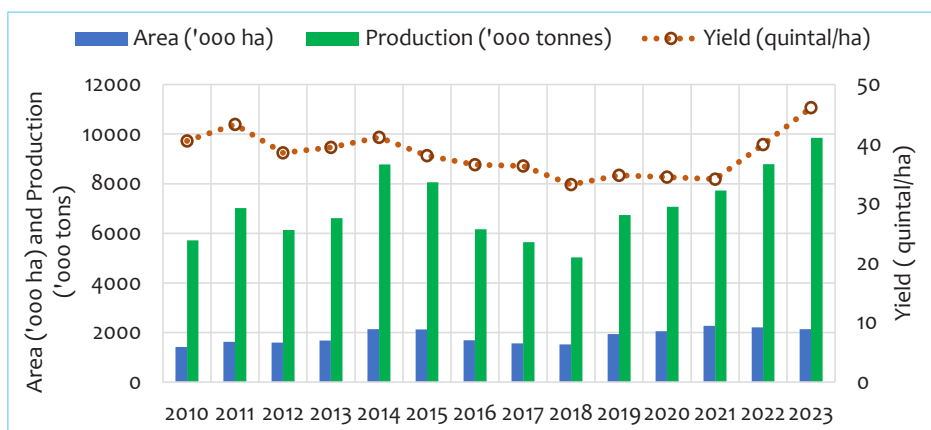
Current Status of Basmati Rice in India

This chapter presents the status of Basmati rice in India, covering trends in area, production, and yield, the state-wise distribution of cultivation and the export scenario.

2.1 Trends in area and production of basmati rice

Basmati rice production system in India has undergone a significant transformation over the past two decades, driven by the introduction of high-yielding, early-maturing varieties, expansion of irrigation, and rising domestic and international demand. Figure 1 presents the area, production and yield trends of basmati rice in India. The area under basmati rice has significantly expanded from 1,410 thousand hectares in 2010 to 2,135 thousand hectares in 2023. This expansion is mainly due to strong market incentives provided by rising domestic and export prices, the availability of early-maturing high-yielding varieties, and active promotional efforts by Agricultural & Processed Food Products Export Development Authority (APEDA). As a result, the total production of basmati rice increased from approximately 5,715 thousand tonnes in 2010 to 9,846 thousand tonnes in 2023. However, the growth in production has not been linear, sharp year-to-year fluctuations are observed.

Figure 1. Trends in area, production and yield of basmati rice in India, 2010 to 2023



Source: APEDA.

2.2 State-wise area and production of basmati rice

Basmati rice cultivation in India is geographically concentrated within the GI demarcated zone (Table 1). The states of Punjab, Haryana, western Uttar Pradesh, Uttarakhand, and Himachal Pradesh together account for more than 95 percent of the total basmati area as well as production.

Punjab and Haryana, the main basmati-producing states, jointly contribute nearly three-fourths to the total area and production. Punjab alone accounts for 812.39 thousand hectares (38.04%) of the area and contributes 3,843.41 thousand tonnes (39.04%) to production, with a relatively high yield of 4.73 tonnes per hectare. Haryana follows closely, with 787.60 thousand hectares (36.88%) and 3,678.53 thousand tonnes (37.36%), recording a yield of 4.67 tonnes per hectare. Although states such as Uttarakhand, Jammu and Kashmir, and Himachal Pradesh contribute a considerably smaller share, they perform a critical role in preserving varietal diversity of basmati rice and in sustaining cultivation across heterogeneous agro-climatic zones.

Table 1. State-wise area, production, and yield of basmati rice, 2023

States	Area (‘000 ha)	% Share in Area	Production (‘000 tonnes)	% Share in Production	Yield (tonne/ha)
Punjab	812.39	38.04	3843.41	39.04	4.73
Haryana	787.60	36.88	3678.53	37.36	4.67
Uttar Pradesh	461.74	21.62	2049.69	20.82	4.44
Uttarakhand	46.61	2.18	163.90	1.66	3.52
Jammu & Kashmir	19.4	0.91	79.58	0.81	4.10
Himachal Pradesh	7.62	0.36	30.64	0.31	4.02
India	2135.36		9845.75		4.61

Source: APEDA.

Table 2 shows the compound annual growth rate (CAGR) and the Cuddy–Della Valle Instability Index (CDVI) for area and production of basmati rice across states between 2010 and 2023. Haryana emerges as the most stable performer among the major producers, with CAGR of 3.93 percent in area and 3.74 percent in production, with moderate CDVI values of 13.56 and 15.90, respectively. Three conditions support this expansion. A dense milling and export cluster around Karnal, Taraori and Kaithal shortens the marketing chain and lowers price-discovery costs for growers. State crop-diversification incentives, notably the Mera Pani Meri Virasat scheme introduced in 2020, pay farmers to move out of water-intensive common paddy, and a part of the released area has in practice moved into basmati rather than out of rice altogether. And comparatively well-developed contract and aggregation

arrangements with exporters give Haryana growers more reliable offtake than their counterparts elsewhere.

In contrast, the growth in area and production for Punjab have remained essentially stagnant, with CAGR values close to zero, despite the state retaining the largest absolute acreage under basmati. This may be due to the saturation in the traditional basmati belt, binding water constraints, and a gradual shift in new acreage towards Haryana and western Uttar Pradesh. The traditional basmati belt of Amritsar, Gurdaspur and Tarn Taran is close to saturation, leaving limited scope for expansion within the agro-ecologies best suited to the crop. Additionally, the Punjab Preservation of Subsoil Water Act, 2009, which prohibits nursery sowing and transplanting before notified dates, compresses the planting window in ways that interact awkwardly with the longer duration of the higher-value basmati varieties, while binding groundwater constraints limit expansion in the south-western districts.

Uttar Pradesh records a CAGR of 4.42 percent in area and 2.56 percent in production; however, the higher CDVI values indicate higher instability in output. Uttarakhand exhibits the highest growth rates among all states, with a CAGR of 19.32 percent for area and 16.19 percent for production. However, this growth is accompanied by significant instability (CDVI of 79.56 for area and 81.52 for production), suggesting that despite rapid expansion, the state faces challenges in maintaining consistent output levels. In contrast, Jammu and Kashmir registers negative growth in both area (–13.66 percent) and production (–12.42 percent), coupled with high instability.

At the national level, both area and production exhibit moderate positive growth, with CAGR values of 2.63 percent and 2.06 percent respectively, and instability indices of 12.02 and 17.61. This indicates that although basmati rice production is growing, there is a need to manage factors contributing to instability, particularly in Uttar Pradesh and Uttarakhand.

Table 2. Growth and instability in area and production of basmati rice in India, 2010 to 2023

States	Area		Production	
	CAGR	CDVI	CAGR	CDVI
Punjab	0.04	19.13	-0.04	0.21
Haryana	3.93***	13.56	3.74***	15.90
Uttar Pradesh	4.42*	32.42	2.56	35.28
Uttarakhand	19.32***	79.56	16.19***	81.52
Jammu & Kashmir	-13.66***	43.48	-12.42**	50.44
Himachal Pradesh	14.63**	47.85	17.51**	48.38
India	2.63***	12.02	2.06	17.61

Note: ***, **, * indicates significant at 1%, 5% and 10% respectively.

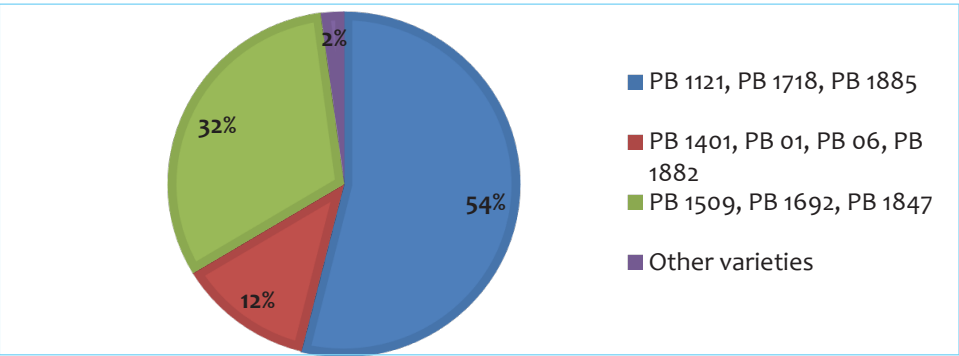
Source: Authors' computation based on APEDA data.

2.3 Varietal diversity of basmati rice

Varietal composition plays a decisive role in shaping the productivity and market orientation of the basmati rice. Figure 2 depicts the varietal diversity in basmati rice production in India in 2023. The Pusa Basmati 1121 (PB 1121) is the most prominent variety, accounts for more than half of the total cultivated area across the major basmati-producing states. This widespread adoption is primarily due to its high yield, long grain, and strong demand in both domestic and export markets. In addition to PB 1121, PB 1718 and PB 1885 also contribute substantially to total production, though their cultivation is more regionally concentrated.

Other varieties, including PB 1509 and PB 1847, occupy a smaller share of cultivated area but nonetheless play an important role in sustaining the resilience of the Basmati rice system. By maintaining a broader genetic base across heterogeneous agro-climatic zones, these varieties reduce the vulnerability of the sector to biotic and abiotic stresses and provide a buffer against the risks associated with monoculture.

Figure 2. Varietal diversity in basmati rice production in India, 2023



Source: APEDA.

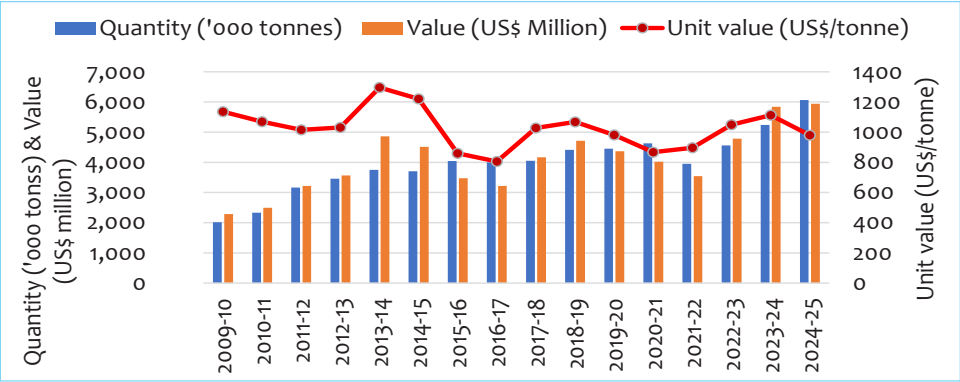
2.4 Export performance

The trade dynamics of basmati rice has undergone significant change over the past decade. The export of basmati rice has been experiencing a rising trend both in terms of quantity and value (Figure 3). India continues to dominate the global basmati rice market, with exports of 6,065 thousand tonnes valued at US\$ 5,944.42 million in 2024–25 (Figure 3). As a result, basmati rice accounts for about 11.4 percent of India’s total agri export value. The main export destinations include Saudi Arabia, Iraq, Iran, the United Arab Emirates (UAE), and the Republic of Yemen, which together constitute a significant share of total exports. Additionally, the Agricultural and Processed Food Products Export Development Authority (APEDA) has facilitated export operations by issuing 43,262 Registration-Cum-Allocation Certificates (RCAC) to basmati rice

exporters in accordance with foreign trade regulations, thereby streamlining export procedures and ensuring compliance.

Rising export volumes, however, need not translate into proportionate gains in export earnings. Unit value realization, defined as the ratio of export value to export quantity, captures the average price that Indian basmati commands in international markets and is therefore a more direct indicator of value capture than either volume or aggregate value alone. Realization rose to a peak of US\$ 1,296 per tonne in 2013–14 and then declined steeply to US\$ 806 per tonne by 2016–17, coinciding with a downturn in world rice prices, payment and sanction-related disruptions in trade with Iran, and intensified competition from Pakistan. Realization recovered thereafter to US\$ 1,113 per tonne in 2023–24, but the recovery proved short-lived: in 2024–25 it fell by nearly 12 percent to US\$ 980 per tonne, even as shipments touched a record 6,065 thousand tonnes. Over the full period, export quantity grew at 7.62 percent per annum against 6.57 percent for export value, so that unit value realization declined at 0.97 percent per annum (US\$ 8.7 per tonne every year).

Figure 3. Trends in quantity, value, and unit value realization of basmati rice exports from India, 2009-10 to 2024-25



Source: Authors’ computation based on APEDA data.

3.1 Data and study area

To assess the economic impact of GI certification, this study relies on both primary and secondary data. Primary data were collected from basmati rice cultivating farmers across the GI demarcated and non-GI border areas through a structured interview schedule administered via personal interview. The primary data captured detailed information on socioeconomic characteristics of the farm household, input use patterns and cost of cultivation, variety planted and cultivation practices, farm-gate price realization for Basmati rice, net farm income from Basmati cultivation, and access to markets, extension services, and institutional credit.

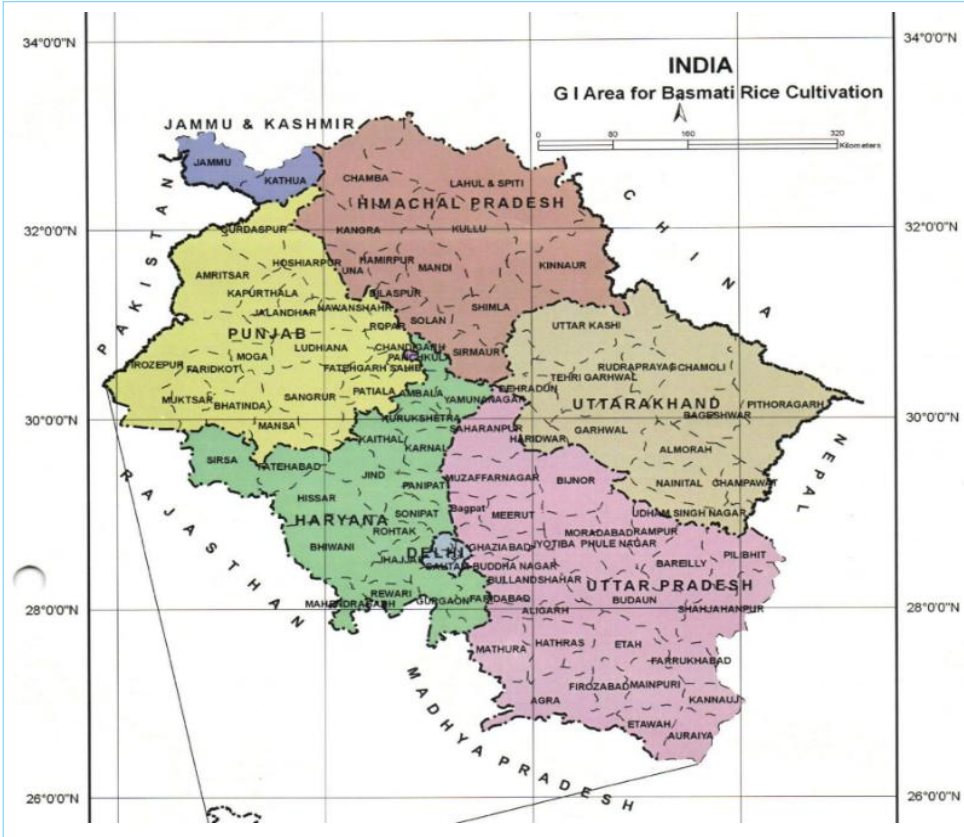
The GI demarcated area for Basmati rice includes the entire states of Punjab, Haryana, Delhi, Himachal Pradesh, and Uttarakhand, and designated parts of western Uttar Pradesh and Jammu & Kashmir, as approved by the GI Registry in 2016 (Figure 4). Farms located within these administrative boundaries are eligible for GI treatment, whereas farms cultivating Basmati rice outside this boundary constitute the control group.

A multi-stage stratified random sampling procedure was adopted. The study area was classified into three strata based on the distance from the demarcated GI boundary. Stratum I comprised districts falling within 100 km of the GI boundary; Stratum II comprised districts falling between 100 km and 200 km from the boundary; and Stratum III comprised districts located more than 200 km from the boundary. From Stratum I, a total of 200 farmers were surveyed: 100 from Hisar, 25 from Jind, and 75 from Kaithal in Haryana. From the second stratum, Meerut district (Uttar Pradesh) was selected, where 50 basmati farmers were surveyed. In the third stratum, Yamuna Nagar (Haryana) was selected, and 50 basmati farmers were surveyed.

In the non-GI area, similar approach was followed. In the first stratum (within 100 km), Hanumangarh (Rajasthan) and Gwalior (Madhya Pradesh) were selected, with 100 farmers surveyed from each district. In the second stratum (100–200 km), Datia (Madhya Pradesh) was selected with a sample of 50 farmers, and in the third stratum (above 200 km), Shivpuri (Madhya Pradesh) was selected, also with 50 farmers surveyed. The total primary sample thus comprised 600 Basmati rice farm households, with 300 each from GI-

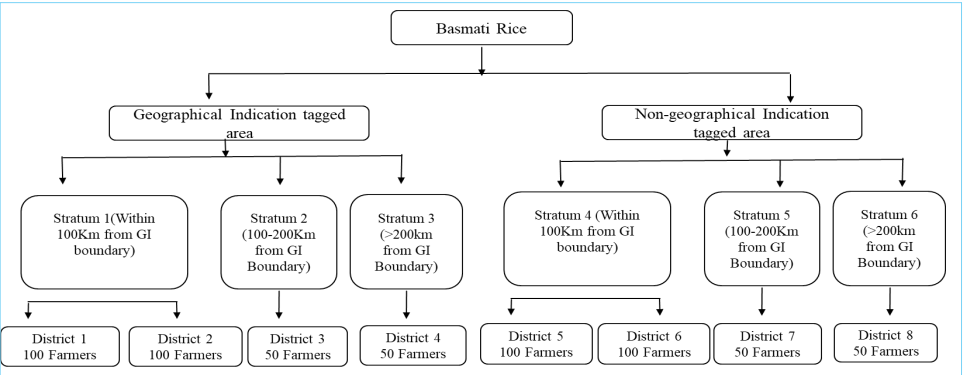
designated areas and non-GI areas. The structure of the sampling design is depicted schematically in Figure 5.

Figure 4. Geographic boundary for basmati rice as approved by GI registry in 2016



Source: GI registry Chennai.

Figure 5. Schematic representation of the multi-stage stratified sampling design



Source: Authors' construction

The secondary data was collected from various Government publications/websites. The data related to production, export and import were collected from publications of Agricultural and Processed Food Product Export Development Authority (APEDA) and Directorate General of Commercial Intelligence and Statistics (DGCIS).

3.2. Analytical methods

3.2.1 Geographical regression discontinuity (GRD) design

The core analytical framework of this study is the geographical regression discontinuity design, which is a spatial extension of the standard regression discontinuity (RD) methodology. The RD design exploits a sharp discontinuity in the probability of treatment at a known threshold of a continuous assignment variable to identify causal treatment effects (Imbens and Lemieux, 2008; Lee and Lemieux, 2010). The GRD design addresses the fundamental challenge of causal identification in the GI impact literature: farms in GI and non-GI areas may differ systematically in unobservable characteristics such as soil quality, agro-climatic advantages, farmer skill, and access to institutions that are correlated with both GI adoption and farm income. By restricting comparison to farms located in close proximity to the GI boundary where such unobserved differences are minimized by spatial continuity, the GRD design provides a credible quasi-experimental counterfactual and yields estimates that approximate local average treatment effects (LATEs).

In this study, the GI demarcation boundary serves as the threshold, and the distance of each farm from this boundary is the assignment variable. The cut-off represents the boundary which is normalized to zero and the distance from this boundary serves as the treatment-determining variable. The farms located inside the GI demarcated area receive a positive distance value, while farms located outside receive a negative distance value. This configuration creates a 'sharp' RDD (as opposed to a 'fuzzy' RDD) because eligibility for GI treatment is determined deterministically by location, any farm within the GI boundary can potentially adopt the GI certification, whereas farms outside the boundary are categorically ineligible (Imbens and Lemieux, 2008). While farms within the GI zone may choose not to formally adopt GI certification, they retain structural eligibility, and their proximity to the boundary controls for the spatial continuity assumption critical to the design.

To evaluate the causal effect of GI status on farm-level outcomes, the following semi-logarithmic specification is estimated:

$$\ln Y_i = \alpha_0 + \alpha_1 GI_i + \alpha_2 D_i + \alpha_3 X_i + \varepsilon_i$$

Where:

Y_i = dependent variable for farm i ; specifically, (a) net farm income from Basmati cultivation (Rs./acre) and (b) price realization at farm-gate (Rs./quintal);

GI_i = binary treatment variable; takes the value 1 if farm i is located within the GI demarcated area, and 0 otherwise;

D_i = distance in kilometres of farm i from the GI boundary (the boundary is normalized to zero such that farm i has positive distance if located inside the demarcated area and a negative distance if located outside the demarcated area);

X_i = vector of farm and farmer-level covariates (variety cultivated, age, education, gender, farm size, irrigated area share, livestock holding, subsidiary occupation, non-farm income, and distance to nearest procurement centre); and

ε_i = random error term.

4

Evolution of Geographical Indications in India

4.1 International framework

The international legal foundation for GI was laid by the agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) under the World Trade Organization (WTO), which came into force in 1995. Article 22(1) of TRIPS defines GIs as ‘indications which identify a good as originating in the territory of a member, or a region or locality in that territory, where a given quality, reputation or other characteristic of the good is essentially attributable to its geographical origin’ (WIPO, 2023). The TRIPS framework created binding multilateral obligations for all WTO member countries to provide minimum standards of GI protection. Article 23 provides enhanced protection specifically for wines and spirits, preventing any use of the GI name regardless of misleading intent whereas Article 22 governs other products, including agricultural goods such as rice.

Before TRIPS, GI-related protection was available through earlier agreements: the Paris Convention for the Protection of Industrial Property (1883), which introduced the concept of protecting indications of source; the Madrid Agreement for the Repression of False or Deceptive Indications of Source on Goods (1891), which prohibited misleading origin claims; and the Lisbon Agreement for the Protection of Appellations of Origin (1958), managed by WIPO, which provided an international registration system for appellations of origin. While these agreements built a normative foundation, TRIPS created the binding, enforceable multilateral framework that compelled India as a WTO member to enact dedicated domestic GI legislation.

4.2 Chronological evolution of GI in India

01

Pre-1999

Collective Marks under Trademarks Act (1958): First Indirect GI Protection

Before India had a specific GI law, the Trademarks Act of 1958 allowed regional producers’ associations to register collective marks. While this provided some protection against misrepresentation, it did not address the fundamental link between product quality and geographical origin. Products like Darjeeling Tea and Mysore Silk maintained their reputation through informal mechanisms, demonstrating the economic value of origin-linked product identity and the institutional gap awaiting legislative remedy.

U.S.-India Basmati Patent Dispute: A Catalyst for Action

02
1997

In 1997, RiceTec Inc., a Texas-based company, was granted a patent by the USPTO on certain strains of Basmati rice and the right to use the name 'Basmati' for its products. This decision triggered international outrage and a concerted diplomatic and legal effort by India to contest the patent. India argued that 'Basmati' is a geographical name inseparable from the rice's origin in the Indo-Gangetic Plains — not a freely usable descriptor. After prolonged legal proceedings, several key RiceTec patent claims were revoked. This dispute became a powerful catalyst for India's GI legislation, demonstrating the vulnerability of traditional products in international IP regimes and the need for proactive legal protection.

Geographical Indications of Goods (Registration and Protection) Act, 1999

03
1999

In response to India's TRIPS obligations and the Basmati patent controversy, Parliament enacted the Geographical Indications of Goods (Registration and Protection) Act, 1999. This *sui generis* framework defined GIs, established a registration and enforcement system, specified the rights of registered proprietors and authorised users, and prescribed penalties for infringement. It went beyond TRIPS minimum requirements in covering agricultural, natural, manufactured and handicraft goods, and created a two-tier structure distinguishing the registered proprietor from the authorised users permitted to apply the GI name.

GI Act Enforcement & Establishment of the GI Registry, Chennai

04
2003

The GI Act came into force on 15 September 2003, simultaneously with the establishment of the Geographical Indications Registry (GIR) in Chennai under the Office of the Controller General of Patents, Designs & Trade Marks (CGPDTM). The Registry was mandated to receive, examine, register, and maintain records of GI applications; publish the GI Journal; manage the Register of Geographical Indications; and adjudicate opposition proceedings. The establishment of a dedicated Registry marked India's transition from legislative intent to operational GI management, providing the institutional infrastructure for the subsequent surge in GI registrations.

05

2004

Darjeeling Tea: India's First Agricultural GI Registration

Darjeeling Tea became India's first registered GI in 2004, establishing the operational precedent on which subsequent agricultural GI applications, including Basmati, were built. Its GI status has since been associated with a price premium of 15–25 percent over non-certified teas in international markets, providing early evidence that origin protection can be converted into commercial value.

06

2006-
2008

Surge in Agricultural GI Applications: Building India's GI Portfolio

Following the Darjeeling precedent, GI applications for Indian agricultural products rose sharply between 2006 and 2010. The development directly relevant to this study came in 2008, when APEDA filed an application with the GI Registry seeking GI status for Basmati rice — a pivotal step that would take eight years to reach fruition, and part of India's strategic effort to protect its most valuable agricultural export from international imitation.

07

2010

GI Amendment Act (2010) & Madhya Pradesh Boundary Controversy

Two developments marked 2010. The Geographical Indications (Amendment) Act simplified administrative procedures and shortened registration timelines, making the system more accessible to smaller producer associations. More consequentially for Basmati, Madhya Pradesh argued that 13 of its districts should be included in the Basmati GI zone on historical cultivation grounds. The claim was contested by existing Basmati-producing states and by scientific authorities who held that the state's agro-climatic conditions did not support authentic Basmati quality. The controversy exposed the tension in GI boundary delineation between economic inclusion and quality integrity — a tension that remains central to Basmati GI policy.

08

2016

Basmati Rice GI Registration: A Landmark for Indian Agriculture

After eight years of examination and extensive quality documentation, the Geographical Indications Registry granted GI status to Basmati rice in 2016. This registration formally demarcated the Basmati growing zone (Punjab, Haryana, Delhi, Himachal Pradesh, Uttarakhand, designated districts of western UP and J&K),

specified the quality parameters that define authentic Basmati, and provided legal protection against misuse of the ‘Basmati’ name by producers outside the demarcated area. The registration was a major victory for Indian farmers and exporters, providing legal backing for premium pricing, enabling the Basmati.Net traceability system, and strengthening India’s position in international trade disputes. It also created the spatial discontinuity that this study exploits for causal impact evaluation.

09
2018-
2020

FSSAI Standards and Basmati Traceability: Strengthening the Quality Ecosystem

APEDA expanded and upgraded the Basmati.Net platform between 2018 and 2020 to enable comprehensive farm-level traceability, linking over 1.5 lakh registered farmers’ fields to export consignments through geo-tagging and digital record-keeping. The system became essential for sanitary and phytosanitary compliance in EU and UK markets, where buyers increasingly demanded traceability documentation. Preliminary FSSAI consultations on Basmati quality standards also began in this period, eventually leading to the comprehensive regulations of 2023. APEDA additionally launched GI awareness campaigns in major Basmati-growing districts, though farmer awareness of GI provisions, particularly among smallholders, remained a challenge.

10
2020

EU GI Application: India’s Bid for International Recognition

In 2020, India formally applied to the European Union for recognition of ‘Basmati’ as a Protected Geographical Indication (PGI) under EU Regulation No. 1151/2012. If granted, EU GI recognition would provide powerful legal protection in one of the world’s most sophisticated and high-value food markets, preventing any EU member state from importing or selling rice labelled ‘Basmati’ that does not originate from India’s GI-demarcated area. However, Pakistan immediately filed a formal objection with the European Commission, asserting that Basmati rice is also cultivated in Pakistan’s Punjab region and has a shared geographical heritage. This ongoing dispute — which has no clear timeline for resolution — is a defining challenge for India’s international GI strategy and illustrates the complexities of cross-border GIs for products with trans-boundary cultivation histories.

FSSAI Basmati Quality Regulations: Domestic Enforcement Framework

11
2023

In 2023, FSSAI notified the Basmati Rice (Quality and Standards) Regulations, creating a domestic quality enforcement framework for the first time. The regulations codified the parameters defining authentic Basmati including grain dimensions, aroma compound levels and admixture limits, restricted the mixing of non-Basmati varieties, and mandated testing and certification for Basmati marketed domestically, closing the gap between the GI Registry's standards and actual market enforcement.

GI Portfolio Expansion: 724 Registrations and Growing

12
2024-
2026

As of 31 March 2026, India's GI Registry has registered 724 GIs covering agricultural products, handicrafts, manufactured goods, and foodstuffs. Among these, 31.4% are agricultural products. The government's 'One District One Product' (ODOP) initiative has further catalysed GI applications from tier-2 and tier-3 districts. Digital GI management, drone-based field verification, and blockchain-based traceability are emerging as tools to strengthen GI administration.

Geographical indications have increasingly emerged as an important policy instrument for linking agricultural products to their place of origin, thereby enhancing market differentiation, protecting traditional knowledge, and promoting rural livelihoods. Hence, GIs are often expected to create premium markets, strengthen export competitiveness, and ensure equitable value distribution along the supply chain. However, the critical question remains whether GI certification actually translates into higher price realisation and net income of the farmers? In this chapter, we examined the impact of GI certification on price and net income of basmati rice farmers.

5.1 Demographic characteristics of the sample group

Table 3 depicts the socio-economic characteristics of the respondents included in the study. Control-group farmers have a mean age of 50 years and farming experience of 32.5 years, reflecting the more established farming communities in the study area whereas treated-group farmers have mean age of 45.9 years with 27 years of average farming experience. Both groups have comparable family sizes and near-identical average landholdings. The mean distance from the GI boundary for treated group is +101.4 km, with the positive sign indicating location inside the GI-demarcated area. The minimum value of 7 km confirms that several treated farms lie immediately adjacent to the boundary, providing the local variation required for credible identification under the GRD design. On the other hand, the mean distance from the GI boundary for the control group is -88.6 km (range: -218 to -3 km), where the negative sign denotes location outside the GI-demarcated area. The fact that the upper bound is only -3 km confirms that a substantial share of control farms lies in close proximity to the boundary, which is essential for the spatial-continuity assumption of the GRD design.

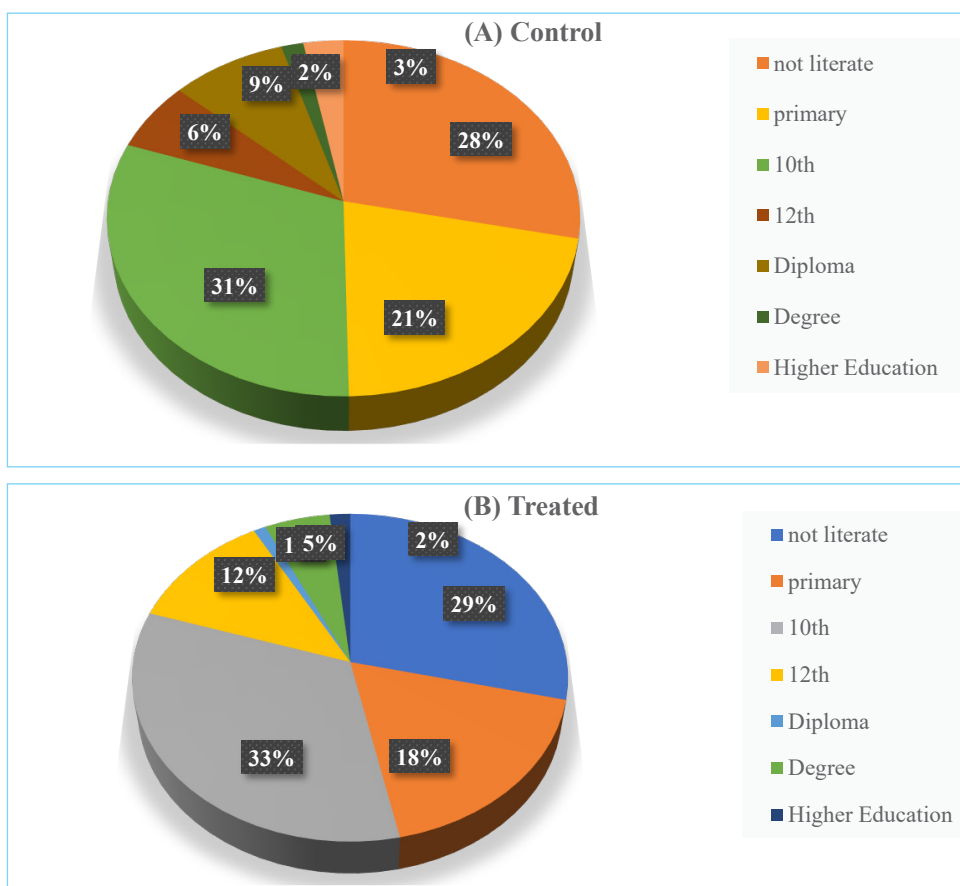
Furthermore, male farmers account for 91% of the control group and 93.7% of the treated group, reflecting the broader pattern of male dominance in agricultural decision-making across north Indian farming households. In terms of educational attainment, both groups exhibit low levels of formal education: approximately 28% of farmers in each group are illiterate, with the majority having completed only primary or secondary schooling (Figure 6).

Table 3. Descriptive statistics of farm household characteristics across treated and control groups

Variable name	Control group		Treated group	
	Mean	Std Deviation	Mean	Std Deviation
Age (Years)	50	12.5	45.9	13.2
Farming experience (Years)	32.5	13.1	27	13.7
Family size (No.)	4.7	2.3	5.3	2.4
Owned land (Acres)	3.7	3.9	3.5	3.8
Distance from GI Boundary (KM)	-88.6	65.4	101.4	67.3

Source: Authors' computations based on primary data.

Figure 6. Educational attainment among sample farmers, by treatment status

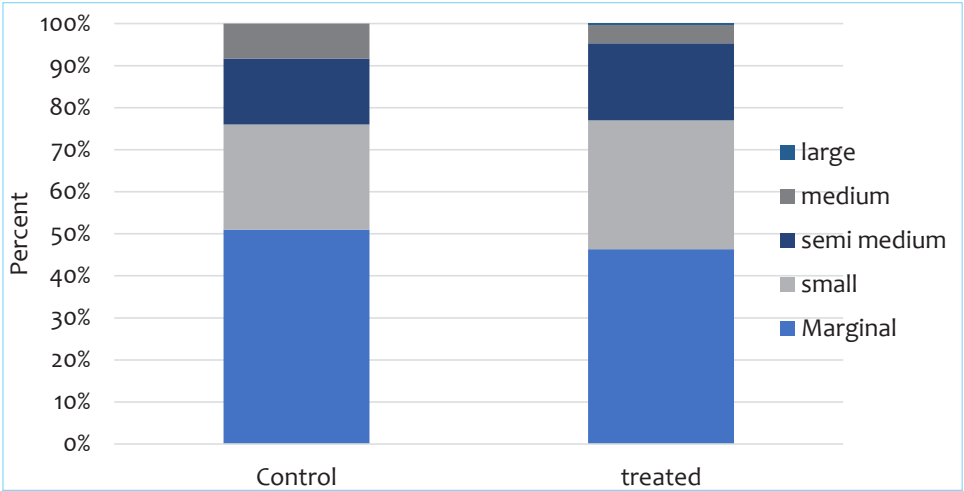


Source: Authors' computations based on primary data.

Figure 7 provides an overview of the distribution of land classes among the sample group, categorized into marginal, small, semi-medium, medium, and large landholders. In the control group, 153 farmers (51.0%) are marginal

(landholding < 1 ha) and 75 (25.0%) are small (1-2 ha). The treated group shows a similar pattern: 139 marginal (46.3%) and 92 small (30.7%) farmers. This indicates that the welfare impact of GI is concentrated in the segment of the farming population with the least bargaining power in agricultural markets. Additionally, the near-identical distribution of farm-size classes across the two groups is an important confirmation that scale-driven differences in market access do not confound the GRD estimates.

Figure 7. Distribution of land-size classes across treated and control groups



Source: Authors’ computations based on primary data.

5.2 Varietal distribution in the sample group

Table 4 presents the district-wise distribution of Basmati rice varieties across the sample. PB1121 is the single most widely cultivated basmati variety, dominant in Hisar (66%), Shivpuri (50%), and Gwalior (29%), owing to its exceptional elongation ratio and strong export demand. In Jind and Meerut, the distribution is more balanced among multiple varieties. In Jind, PB1509 holds 32%, PB1718 28%, and PB1121 24%, while Meerut has the largest area for PB1509 (40%), followed by PB1121 (26%) and Sugandha (10%). Sugandha is particularly significant in Datia and Gwalior, where it occupies 48% and 42%, respectively, indicating these regions’ strong preference for this variety over others.

PB1509 leads in Hanumangarh (59%) and Meerut (40%), reflecting its early-maturity advantage in water-stressed environments.

Kaithal shows a prominent cultivation of PB1718 at 39%, which is comparatively high, alongside PB1121 (27%) and other varieties. Yamuna Nagar, on the other hand, is largely devoted to PB1 (42%), with PB1509

occupying a considerable share (32%). In districts like Hanumangarh, there is a marked concentration on PB1509 (59%), signifying that this district heavily specializes in this particular variety.

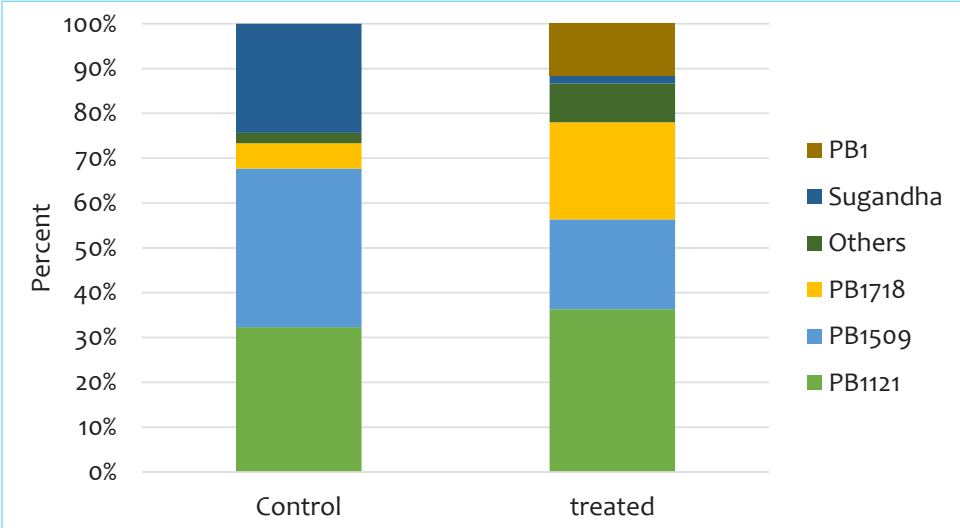
Table 4. District-wise varietal distribution of basmati rice across sample districts (percent)

District	PB1121	PB1509	PB1718	Others	Sugandha	PB1
Hisar	66	11	18	1	0	4
Jind	24	32	28	16	0	0
Kaithal	27	7	39	20	0	7
Yamuna Nagar	8	32	10	8	0	42
Meerut	26	40	12	4	10	8
Datia	16	28	8	0	48	0
Gwalior	29	23	4	2	42	0
Shivpuri	50	20	6	10	14	0
Hanumangarh	35	59	6	0	0	0

Source: Authors’ computation based on APEDA data.

Figure 8 shows the varietal distribution, highlighting the dominance of PB1121 and PB1509 varieties. PB1121 is the most cultivated variety, with 97 farmers from the control group and 109 from the treated group reporting its cultivation. PB1509 follows as the second most popular variety, especially in the control group, with 106 farmers cultivating it, compared to 60 in the treated group. PB1718 is also represented, though in smaller numbers, with 17 farmers in the

Figure 8. Varietal distribution among sample farmers, by treatment status



Source: Authors’ computations based on primary data.

control group and 65 in the treated group. Other varieties such as Sugandha and PB1 have limited representation, especially in the treated group, where only 5 farmers cultivate Sugandha and 35 grow PB1. This figure illustrates the prevalence of PB1121 and PB1509 in the sample group, with some variation in the adoption of other varieties like PB1718 and Sugandha.

5.3 Effect of GI on farm-gate price of basmati rice

Table 5 presents the statistical details for the geographic regression discontinuity design and estimated impact of the GI on the price of basmati rice. Of the 600 total observations, 75 and 54 effective observations are used on the left (control) and right (treated) sides of the cut-off, respectively. The bandwidth estimation (BW est.) for both sides was 32.664, with a bias bandwidth of 60.483. The ratio between the two (ρ) is 0.54, indicating moderate precision in the estimation. The analysis applied a triangular kernel and the mean squared error rule for selecting bandwidth, ensuring that the chosen bandwidth minimizes the variance-bias trade-off. The variance-covariance estimation (VCE) method used was nearest neighbour (NN), providing robust standard errors for the coefficient estimates.

The results indicate that GI registration has a positive and significant effect on basmati rice price across all estimation methods. The conventional estimate shows that GI status increases the price of basmati rice by Rs. 224.8 per quintal compared to non-GI Basmati. After correcting for potential matching bias, the bias-corrected estimate reports a slightly lower impact of Rs. 183.7 per quintal (Rs. 1,837 per tonne), but the effect remains statistically significant. Furthermore, the robust coefficient, which accounts for heteroscedasticity and other potential deviations from standard assumptions, also reports a similar increase of Rs. 183.7 per quintal (Rs. 1,837 per tonne). A premium price of Rs.184–225 per quintal represents an 8–11 percent price advantage for GI-certified farmers.

Figure 9 further supports these findings. The regression discontinuity plot shows a clear discontinuity at the cutoff point (Score = 0), represented by the vertical line. The observations on the right side of the threshold (GI-treated group) exhibit noticeably higher outcome values compared to those on the left side (non-GI group). The fitted polynomial curves also reveal a distinct upward jump at the cutoff, indicating that farmers or producers associated with the GI region receive higher prices for basmati rice relative to comparable non-GI producers. Thus, it is clear that even after accounting for possible estimation bias, GI protection continues to provide a substantial price premium to farmers. The increase in premium price mainly attributed to the perceived quality and authenticity associated with GI-certified products, making them more desirable to consumers and buyers in domestic and international markets.

Three implications follow from the magnitude of this premium. First, at the national average basmati yield of 4.61 tonnes per hectare (18.7 quintals per acre), a bias-corrected premium of Rs. 183.7 per quintal translates into roughly Rs. 3,428 per acre of additional gross value. The convergence of two separately estimated effects indicates that the price premium is not offset by higher costs of cultivation or compliance within the GI zone; it is retained at the farm rather than spent on obtaining it. Second, for the average sample household cultivating 3.5 acres, the premium amounts to approximately Rs. 13,300 in additional net income from a single basmati season, an additional increment for holdings that are predominantly marginal and small. Third, the farm-level premium is modest relative to the value realised at the border. Converting the paddy premium at a milling recovery of about 67 percent yields about US\$ 32 per tonne of milled rice, or about 3 percent of the export unit value of US\$ 980 per tonne (2024-25). GI protection therefore transmits a real but small share of export value to the farm gate.

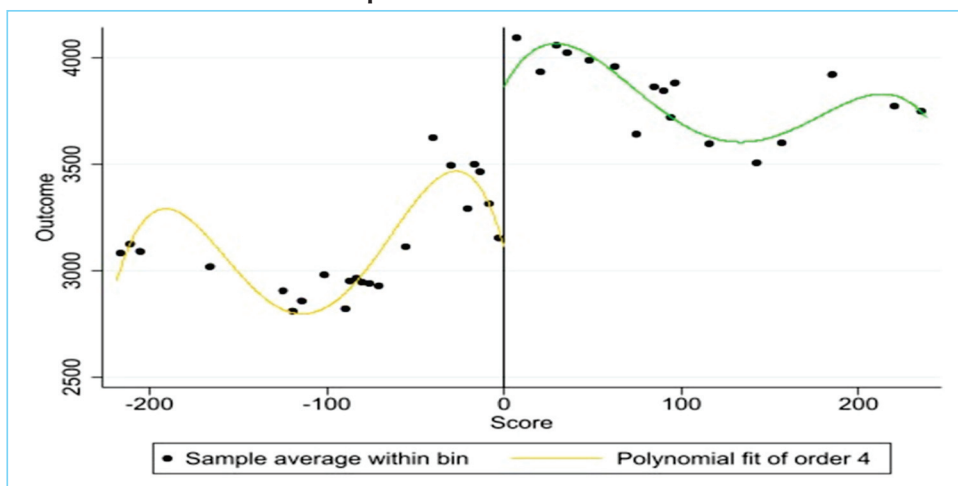
Table 5. Impact of GI on farm-gate price of basmati rice

Number of observations				600
BW type				mserd
Kernel				Triangular
VCE method				NN
Cut-off $c = 0$				Left of c Right of c
Number of observations				300 300
Eff. Number of observations				75 54
Order est. (p)				1 1
Order bias (q)				2 2
BW est. (h)				32.664 32.664
BW bias (b)				60.483 60.483
ρ (h/b)				0.54 0.54
Method	Coefficient	Std. Err.	z	95% Confidence Interval
Conventional	224.8***	60.0	3.7	107.2—342.3
Bias-corrected	183.7***	60.0	3.1	66.1—301.2
Robust	183.7**	79.0	2.3	28.9—338.4

Note: ***, ** indicates significant at 1% and 5% respectively.

Source: Authors’ computations based on primary data.

Figure 9. Regression discontinuity plot: effect of GI on farm-gate price of basmati rice



Source: Authors' computations based on primary data.

5.4 Effect of GI on net income from basmati rice cultivation

Table 6 presents the estimated impact of GI status on net income from basmati rice cultivation. The results consistently indicate that GI registration has a positive and statistically significant effect on farmers' net income.

Table 6. Impact of GI on net income from basmati rice cultivation

Number of observations				600
BW type				mserd
Kernel				Triangular
VCE method				NN
Cut off $c = 0$				Left of c Right of c
Number of observations				300 300
Eff. Number of observations				59 25
Order est. (p)				1 1
Order bias (q)				2 2
BW est. (h)				19.60 19.60
BW bias (b)				54.98 54.98
ρ (h/b)				0.36 0.36
Method	Coefficient	Std. Err.	z	95% Confidence Intervals
Conventional	3449***	403.2	8.55	2658.2 — 4239.1
Bias-corrected	3792***	403.2	9.40	3001.6—4582.5
Robust	3792***	440.4	8.61	2928.9—4655.3

Note: *** indicates 1 percent level of significance.

Source: Authors' computations based on primary data.

The conventional estimate shows that GI status increases net income of Rs. 3,449 per acre for farmers cultivating GI-certified Basmati. However, after correcting for potential matching bias, the estimated impact increases to Rs. 3,792 per acre. The bias-corrected estimate suggests that earlier estimates may have slightly underestimated the true income advantage associated with GI cultivation. Additionally, robust coefficient supports this, with the increase in net income of Rs.3792 per acre. These estimates further strengthen the argument that GI not only affects the unit price of the product but also results in increased income at the farm level.

Furthermore, to confirm the estimates a falsification test was carried out to verify whether the observed impacts of GI on price and income are driven by factors unrelated to GI certification. The falsification results show no significant relationships between the independent variables (such as age, farming experience, family size, and education) and the outcome variables (price and income). For instance, the p-values for variables like age (0.32) and farming experience (0.24) are well above the typical threshold for statistical significance, indicating that these factors do not explain the variations in price or income observed in the main analysis (Table 7).

This is further confirmed for other control variables like family size, and educational attainment, which exhibit non-significant effects with p-values comfortably above 0.05. The only borderline case is owned land ($p = 0.07$),

Table 7. Falsification test for the independent variables

Variable	MSE optimal bandwidth	RD estimator	p value	Confidence interval	Effective number of observations
Age	47.90	-6.34	0.32	-16.62— 5.46	178
Farming experience	49.51	-7.61	0.24	-18.25— 4.50	178
Family size	64.11	-0.71	0.39	-2.45— 0.96	195
Owned land	50.18	-2.78	0.07	-6.77 — 0.21	179
PB1718	50.55	0.05	0.78	-0.26 — 0.34	179
PB1	54.47	0.03	0.75	-0.13 — 0.18	185
Method of harvest	38.88	-0.29	0.20	-0.88—0.18	155
Primary	46.56	-0.04	0.63	-0.38— 0.23	175
Tenth	45.03	0.21	0.21	-0.16— 0.71	175
Diploma	38.48	0.07	0.24	-0.06— 0.25	151
Degree and higher	46.40	0.09	0.38	-0.13— 0.33	175

Source: Authors' computations based on primary data.

which is marginally significant at the 10% level; this likely reflects a modest correlation between farm size and proximity to the GI boundary rather than a violation of the identifying assumption, since the magnitude of the coefficient is small and the effect is statistically insignificant at the conventional 5% threshold. For example, the coefficient for family size is -0.71 with a p-value of 0.39, suggesting no meaningful impact of family size on price or income outcomes. Similarly, variables related to the types of varieties cultivated (such as PB1718 and PB1) show no significant impact, with p-values of 0.78 and 0.75, respectively. This strengthens the conclusion that the observed impacts of GI certification are genuine and not confounded by these extraneous variables.

Geographical Indications have, over the past two decades, evolved from a relatively obscure category of intellectual property protection into a mainstream instrument of agricultural value creation and rural development in India. The enactment of the Geographical Indications of Goods (Registration and Protection) Act in 1999 and the subsequent establishment of the GI Registry in 2003 created the legal and institutional infrastructure through which India has progressively built a portfolio of 724 registered GIs by 31 March 2026, of which 31.4 percent are agricultural products. The 2016 registration of Basmati rice, achieved after eight years of examination and opposition proceedings, was a defining moment in this trajectory. Basmati combines all the attributes that justify GI protection: a long history of cultivation in a clearly identifiable agro-ecological zone, distinctive sensory characteristics that are inseparable from that zone, an established export market in which authenticity commands a premium, and a producer constituency that is overwhelmingly composed of smallholders. Notwithstanding this institutional progress, the empirical question of whether GI protection actually delivers tangible welfare gains to the producers it is designed to benefit has remained inadequately addressed. The present study has sought to fill that gap.

Basmati rice sector emerged as one of India's most successful agricultural export industries, registering substantial growth in area, production, and international trade over the past decade. Between 2010 and 2023, the cultivated area expanded by 51.4 percent, while production increased to nearly 9.85 million tonnes, driven largely by the widespread adoption of high-yielding varieties such as Pusa Basmati 1121. India remains the dominant player in the global Basmati market, with exports valued at nearly US\$ 6 billion in 2024–25. The findings revealed that GI certification provides a modest price premium to Basmati rice farmers (Rs. 183.7 per quintal) compared to non-GI farmers. The convergence of the price and income effects demonstrates that the GI premium flows through to farm-level profitability and is not absorbed entirely along the value chain. The GI farmers had net income gain of Rs. 3,792 per acre over non-GI farmers.

The findings of this study suggest that the long-term sustainability and competitiveness of the Indian basmati sector require a dynamic and science-based approach to GI governance. Given the demonstrated farm-level price premium associated with GI status, there is a strong case for periodically reviewing the existing basmati GI demarcated area and considering the inclusion of eligible basmati-growing regions, based on rigorous scientific validation of their agro-climatic suitability and quality characteristics. Any expansion should preserve the integrity of the basmati brand by recognising that its distinctive attributes arise from the interaction of geography, environmental conditions, soil properties, genetics, and cultivation practices. Strengthening digital traceability systems alongside GI expansion will be critical for maintaining authenticity, enhancing consumer confidence, and ensuring compliance with international market requirements.

At the same time, safeguarding and enhancing the economic value of Indian basmati will require a coordinated strategy that integrates scientific research, legal protection, institutional strengthening, and global market development. Investments in multidisciplinary research can provide a robust evidence base for GI governance, support India's position in international disputes, and improve production practices without compromising product identity. Strengthening India's international GI protection strategy, promoting global branding and trade promotion initiatives, and enhancing institutional capacity across the basmati value chain through farmer producer organisations, extension services, quality seed systems, and improved production technologies will help expand market opportunities and ensure that the benefits of the GI premium are more widely shared among farmers and other stakeholders. Together, these measures can reinforce India's leadership in the global basmati market while promoting inclusive and sustainable agricultural development.

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