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RESEARCH PAPER

Assessment of Marketed Surplus and Marketing Efficiency of Rice in Banda District, Uttar Pradesh

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ABSTRACT

Rice is a vital cereal crop that sustains more than half of the global population and remains central to India's food security and rural economy. As the world's second-largest rice producer, India relies heavily on this crop for livelihoods and agricultural income. This study examines the marketed surplus and marketing efficiency of rice across different farm-size categories in Banda district, Uttar Pradesh. Primary data were collected from 160 rice-growing households through stratified random sampling in two purposively selected blocks, Baberu and Naraini. The findings reveal significant variation in marketed surplus across farm sizes, with large farms marketing 205.57 quintals, medium farms 116.07 quintals, small farms 27.67 quintals, and marginal farms 8.44 quintals. Marginal farmers frequently sold beyond their marketable surplus, indicating financial stress and the need for liquidity. A multiple linear regression analysis was carried out to identify the determinants of marketed surplus across farm categories. Among three identified marketing channels, Channel II (producer → wholesaler → retailer → consumer) accounted for 57.8% of total sales, while Channel III (direct producer → consumer) exhibited the highest producer price share (96.45%) and marketing efficiency (27.26). The study underscores the importance of promoting shorter marketing chains, farmer cooperatives, and improved access to market information to enhance efficiency and farmer welfare in the rice sector.

HIGHLIGHTS

- Shorter marketing chains substantially improve farmers' income and marketing efficiency, with the direct producer-to-consumer channel performing best.
- Significant disparities exist across farm sizes, as marginal farmers sell beyond their marketable surplus due to financial distress.
- Regression analysis shows production is the dominant, statistically significant driver of marketed surplus across all farm categories, explaining over 99 percent of variation among marginal, small and medium farms, with a comparatively weaker fit among large farms (R^2 = 0.818) reflecting the smaller sample size in that category.

Keywords: Marketed Surplus, marketable surplus, marketing efficiency, marketing cost

Rice (*Oryza spp.)* is one of the most important cereal crops in the world and serves as the primary staple food for more than half of the global population. It is the third most produced crop globally after sugarcane and maize, with a total output of 502 million metric tons. China, India, and Bangladesh are the leading producers, contributing 148.99, 129.47 and 35.85 million metric tons (FAO 2023). Global

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consumption has shown consistent growth, rising from 437.18 million metric tons in the year 2008 to more than 520 million metric tons in 2021(DES, 2023).

India, the second largest producer of rice, records a harvest of 136.7 million tons. Rice occupies a major share of the cultivated land, provides livelihood opportunities to millions of farm households, and remains an essential component of the national diet. Uttar Pradesh is the largest producing state with an output of 58.32 million metric tons which represents 18.89 percent of national production. It is followed by Madhya Pradesh with 31.96 million metric tons and Punjab with 29.77 million metric tons according to official data. Rice cultivation supports 57.8 percent of rural households in India and 82 percent of these households are classified as small or marginal farmers (DES, 2023)

From an economic point of view, marketing efficiency plays a crucial role in determining the income of the farmers obtained from rice cultivation. The structure of the supply chain and the involvement of intermediaries influence the proportion of the consumer price that ultimately reaches producers. This is consistent with the broader literature on foodgrain marketing in India, which has repeatedly shown that longer intermediary chains erode producer returns (Alagh, 2014; Biradar, 1996). Rice also contributes significantly to global nutritional security by providing about 20 percent of the daily dietary energy supply. It contains 130 kilocalories per 100 grams and is an important source of iron, manganese, and B group vitamins.

In the state of Uttar Pradesh, the Bundelkhand region which consists of the districts of Banda, Chitrakoot, Hamirpur, Jalaun, Jhansi, Lalitpur and Mahoba was selected for the present study. Among these districts, Banda was chosen for detailed investigation because it shows the highest growth rate in rice cultivation. Banda has the largest cultivated area of 111 thousand hectares and a total production of 123.73 thousand metric tons, which makes it an appropriate area for examining marketed surplus and marketing efficiency in rice production.

OBJECTIVES

The objectives of the study are:

- To assess the marketed and marketable surplus of rice in study area:
- To measures the marketing cost, margins and marketing efficiency of rice study area.

METHODOLOGY

The study was carried out in the Banda area of Uttar Pradesh between 2022 and 2023. 160 sample farmers were chosen for the study using a simple random sampling approach. Two blocks (Baberu and Naraini) were purposefully chosen from the Banda district. A list of every village in the chosen development block was created, and the principal villages from each block were chosen at random. Farmers from the chosen village were categorized according to the size of their landholdings. The study's sample consisted of 160 farmers who grew rice.

1. Marketing channels of rice

The marketing channels for rice were identified by considering the involvement of middlemen or intermediaries from the point of production to the final consumer.

2. Marketing cost

The cost of marketing rice was estimated in order to determine the marketing cost. Marketing costs are typically the expenses incurred from the time the crop is harvested until it is in the hands of the final consumer. It covers market fees, labour costs for packing, loading, and unloading, transportation costs, handling costs, storage costs, and weighing costs. The overall cost of rice marketing was calculated after the marketing costs at each stage were determined.

$$C = C_F + C_{m1} + C_{m2} + C_{m3} + \ldots\ldots + C_{mi}$$

Where,

C = Total marketing cost of rice.

C_F = Cost paid by the producer from the time the rice products leave the farm till it is sold by the producer.

C_{mi} = Cost incurred by the i^{th} middleman in the process of buying and selling.

3. Marketing margin

The marketing margin that the i^{th} middleman receives when selling agricultural products is determined by

$$A_{mi} = P_{Ri} - (P_{Pi} + C_{mi})$$

Where,

P_{Ri} = Total value of receipts per unit (sale price).

P_{Pi} = Purchase value of good per unit (purchase price).

C_{mi} = Cost incurred on marketing per unit Producer's Price.

4. Price Spread

The difference between the price that the producer receives and the price that the consumer pays is known as the price spread. It could include margins and marketing expenses. The following is how the price spread analysis was conducted:

Producer's share in consumer's rupee (%) = 100 × (Producer's Price) ÷ (Consumer's Price) Similarly, the share of the total marketing cost and the total marketing margins were also estimated to analyze the price spread.

5. Marketing Efficiency

The concepts of marketing efficiency are very dynamic and broad, and it basically refers to the level of market performance. It is measured in ratios, where a higher ratio indicates greater efficiency and a lower ratio indicates less efficiency. The empirical evaluation of marketing efficiency was used to determine the effectiveness of the different marketing channels that were identified.

5.1. Conventional Method (ratio of output to input):

$$ME = \frac{O}{I}$$

Where,

ME = marketing efficiency, *O* = value added, *I* = Marketing cost.

Value added – the discrepancy between the price that producers receive and the price that consumers pay.

5.2 Shepherd's Method

According to shepherd, a measure of marketing efficiency could be the ratio of the total value of the goods marketed, or the consumer's price, to the marketing cost.

$$ME = \frac{V}{I}$$

Where,

ME = marketing efficiency, *V* = Value of goods sold i.e., Consumer's purchase price, *I* = Total marketing cost.

5.3 Acharya's Method

Idea for comparing the effectiveness of various markets or distribution methods, through the system of measurement of marketing effectiveness.

$$MME = \frac{PP}{MC + MM}$$

Where,

MME = Modified measure of index of marketing efficiency, *FP* = price received by farmer, *MM* = Total marketing margin, *MC* = Total Marketing cost.

6. Statistical Analysis of Marketed Surplus

To identify the factors influencing marketed surplus across farm-size categories, a multiple linear regression model was fitted separately for marginal, small, medium and large farms, using ordinary least squares (OLS):

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + u_i$$

Where, Y = Marketed surplus of rice (quintals per farm); X_1 = Total production of rice (quintals); X_2 = Family consumption requirement (quintals); X_3 = Seed expenditure (₹); X_4 = Hired labour cost (₹); X_5 = Miscellaneous cash expenditure (₹); β_0 = intercept; β_1–β_5 = regression coefficients; u_i = error term. The model was estimated separately for each farm-size category, and the coefficient of determination (R^2) was used to assess the proportion of variation

in marketed surplus explained by the selected variables. The significance of individual coefficients was tested using t-statistics at the 5% and 1% levels.

RESULTS AND DISCUSSION

Marketed and marketable surplus

The total operational landholding across all farm groups is distributed as 0.69 hectares on marginal farms, 1.64 hectares on small farms, 6 hectares on medium farms and 11.36 hectares on large farms (Table 1). The total yield performance on the respective farms comes to 23.61 quintals per hectare on small farms, 23.12 quintals on medium farms, 21.72 quintals on large farms and 21.69 quintals on marginal farms. A close perusal of the table reveals that small farmers obtain the highest yield, followed by medium and large farmers, while marginal farmers remain at the lowest level. This pattern of marketed surplus rising with farm size is consistent with Sharma (2016), who reported a similar positive relationship between farm size and marketed surplus of rice and wheat across major Indian states, and with the district-level evidence of (Tripathi & Rai, 2019) in Ghazipur and (Yadav *et al.* 2020) in Azamgarh, both within the broader Eastern Uttar Pradesh region.

In the case of surplus behavior, the marketed quantity on marginal farms exceeds their marketable surplus, indicating distress sales due to financial pressures. This tendency corroborates the finding of Dey *et al.* 2022) in Rohtas district of Bihar, where liquidity constraints similarly forced small holders to sell beyond their retained requirement immediately after harvest, and is consistent with the broader observation of (Malik *et al.* 1993) that smaller farm categories are more vulnerable to post-harvest cash pressure than larger holdings.

Statistical Determinants of Marketed Surplus

The regression results (Table 2) show that the coefficient of determination is 99.3 percent among marginal farmers, 99.6 percent among small farmers, 99.8 percent among medium farmers and 81.8 percent among large farmers. Production emerges as the strongest and most consistent positive determinant of marketed surplus ($p<0.01$) across all four farm categories.

Table 1: Farm-wise Average Marketable and Marketed Surplus for Rice (Quintals)

Particular	Size of farm				Average
	Marginal	Small	Medium	Large	
Production	14.97	38.72	138.72	246.71	109.78
Total Requirement	6.54	11.05	17.6	29.78	16.2425
Marketable Surplus	8.44	27.67	121.52	216.93	93.64
Marketed Surplus	8.82	27.63	116.07	205.57	89.5225
Marketable Surplus - Marketed Surplus	-0.38	0.04	5.45	11.36	4.1175

Table 2: Regression Estimates of Marketed Surplus by Farm Category

Variable	Marginal	Small	Medium	Large
Intercept (β_0)	-1.330** (0.205)	-2.098** (0.583)	-1.140 (1.839)	-62.594 (45.582)
Production (X_1)	0.923** (0.016)	0.908** (0.014)	0.943** (0.014)	0.868* (0.269)
Family consumption (X_2)	-0.581** (0.076)	-0.526** (0.100)	-0.892**(0.177)	2.420 (2.723)
Seed cost (X_3)	-0.646** (0.094)	-0.477** (0.149)	-0.950** (0.325)	0.970 (5.973)
Labour cost (X_4)	-0.520** (0.067)	-0.278 (0.169)	-0.148 (0.294)	-1.066 (6.679)
Miscellaneous cost (X_5)	-0.496** (0.057)	-0.476** (0.119)	-0.536 (0.302)	7.146 (7.217)
R^2	0.993	0.996	0.998	0.818
F-value	2067.23**	1773.31**	2118.14**	7.17**
N	75	46	25	14

Note: *Figures are OLS coefficients with standard errors in parentheses; * p<0.05, ** p<0.01. Estimated from the household-level survey data provided by the author (n = 160). Because marketed surplus is arithmetically related to production net of family consumption and cash expenditure, part of the very high R^2 for marginal, small and medium farms reflects this accounting relationship rather than a purely behavioral one; production nonetheless remains the substantively important and statistically robust driver of marketed surplus across every farm category.*

Family consumption requirement and seed expenditure exert a significant negative influence among marginal, small and medium farms, while labour wage cost is not a statistically significant determinant in any category except marginal farms. Among large farms, the model explains a comparatively lower share of variation (R^2 = 0.818) and only production remains a significant determinant, which is consistent with the smaller sample size (n = 14) in this category and the resulting reduction in statistical power.

The very high explanatory power for marginal, small and medium farms confirms that marketed surplus is overwhelmingly driven by the volume of production itself, net of what the household retains for consumption and the cash costs incurred in cultivation. The comparatively weaker fit for large farms (R^2 = 0.818) is attributable to the much smaller sub-sample (n = 14), which reduces the precision of the estimated coefficients and their statistical significance; even so, production remains a significant positive determinant (p<0.05) in this category as well. Family consumption requirement and seed expenditure act as significant negative determinants of marketed surplus for marginal, small and medium farms, meaning that higher retained-consumption needs and cultivation costs reduce the quantity a household is able to release to the market, all else equal. Labour cost is a significant determinant only among marginal farms, suggesting that hired-labour dependence has a distinct bearing on surplus generation specifically at this scale, where family labour constraints are more binding.

Block-wise Comparison: Baberu and Naraini

Because market access and infrastructure can vary considerably even within a single district, marketed surplus was additionally examined separately for the two sampled blocks. Table 3 presents the block-wise average marketed surplus by farm category, computed directly from the household-level survey data.

The overall average marketed surplus is higher in Baberu (50.95 quintals per farm) than in Naraini (36.29 quintals per farm), a difference concentrated almost entirely among large farms (169.90 quintals in Baberu against 123.08 quintals in Naraini); marginal, small and medium farms show very similar average surplus across the two blocks. This suggests that block-level differences in marketed surplus in the study area are driven more by the composition and scale of large holdings than by any broad difference in marketing behaviour common to all farm sizes.

Table 3: Block-wise Average Marketed Surplus of Rice by Farm Category (Quintals)

Farm Category	Baberu (n)	Baberu (Mean)	Naraini (n)	Naraini (Mean)
Marginal	34	8.78	41	8.85
Small	23	27.98	23	27.29
Medium	14	114.63	11	117.91
Large	9	169.90	5	123.08
Overall	80	50.95	80	36.29

Marketing Channels

In the study area, these marketing channels were found to be useful for rice marketing.

Channel-I: Producer → village trader → wholesaler → retailer → consumer

Channel-II: Producer → wholesaler → retailer → consumer.

Channel-III: Producer → consumer.

Channel-IV: Producer → Public Procurement → Public Distribution Shop → consumer.

Table 4 clearly shows that most of the rice produce is routed through Channel-II, which accounts for 57.8 percent of the total quantity sold, whereas Channel-I handles 37.1 percent and only 5 percent is transacted through Channel-III. A closer look at the table reveals that 29.41 percent of marginal farmers marketed their produce through Channel-I, while the remaining 70.59 percent preferred Channel-II. Similarly, among small farmers, 28.52 percent used Channel-I and 83.33 percent used Channel-II; for semi-medium farmers the share was 41.67 percent and 58.33 percent; for medium farmers 40 percent and 60 percent; and large farmers sold their entire output through Channel-II.

This distribution pattern indicates a clear preference for regulated markets as farm size increases, consistent with (Kumar *et al.* 2017a), who similarly reported wholesaler-mediated channels as the most widely used route for paddy marketing. The comparatively limited use of Channel-III

Table 4: Adopted Marketing Channels of Sample Farmers

Marketing Channels	Size of Farms				Total	% of Rice marketed
	Marginal	Small	Medium	Large		
I	31(41.33)	21(45.65)	9(36.00)	3(21.43)	64(40.00)	37.10
II	27(36.00)	21(45.65)	15(60.00)	11(78.57)	74(46.25)	57.80
III	17(22.67)	4(8.70)	1(4.00)	0	22(13.75)	5.10

Note: *Farmers avoid the distant APMC mandi and instead sell conveniently at home to visiting village traders.*

(5.10 percent of volume) despite its evident price advantage, discussed below, echoes (Bidyasagar & Nicra, 2017), who observed that direct producer-consumer transactions in Assam remained minor despite offering the highest producer returns, largely due to the small transacted quantities and limited buyer access typical of subsistence-oriented farms. Farmers appear more inclined to sell in regulated markets rather than to village traders, largely due to competitive price offers and the transparency of open auctions, which ensure better price realization. Overall, the table highlights that regulated marketing channels become progressively more important as farm size expands.

Marketing cost, margin, and price spread

The marketing cost, marketing margin, and price spread under the three rice marketing channels are presented in Table 5. In Channel-I, the total marketing cost comes to ₹ 409.52 per quintal, of which producers incur ₹ 113.56, village traders ₹ 76.47, wholesalers ₹ 114.81 due to higher transportation expenses, and retailers ₹ 104.67 mainly on account of labour charges. Despite these cumulative costs, farmers retain 67.58 percent of the consumer's rupee. In Channel-II, producers bear ₹ 130.22 per quintal on various operations such as transportation, weighing, packing, loading, and unloading, cleaning, miscellaneous expenses, and labour, while wholesalers incur ₹ 115.06 with a margin of ₹ 286.78 and retailers spend ₹ 105.76 with a margin of ₹ 327.82. The consumer price in this channel is ₹ 4,558.27 per quintal, yielding a price spread of ₹ 965.65, and the farmer's share in the consumer's rupee stands at 78.82 percent. In Channel-III, the producer alone incurs a marketing cost of ₹ 105.62 per quintal on transportation, weighing, packing, loading, and unloading, cleaning, miscellaneous items, and labour, receiving a net price of ₹ 2,876.74 per quintal, which accounts for 96.45 percent of the consumer's rupee. Overall, the results show clear variation in marketing costs and farmer returns across channels, with Channel-III providing the highest share of the final price due to minimal intermediary involvement. This study is comparable to the high shares reported for direct paddy sales by (Kumar *et al.* 2017a), and considerably higher than the shares recorded through multi-intermediary channels by (Kumar *et al.* 2017b) for rice marketing in Hanumangarh district of Rajasthan, reinforcing the general finding that each additional intermediary erodes the farmer's share of the final price.

Table 5: Distribution of Rice Marketing Margins (₹ /q)

Sl. No.	Particulars	Channel-I	Channel-II	Channel-III
1	Producer's net price	2251.275	3592.615	2876.736667
2	Cost incurred by producer			
(i)	Transportation Cost	29.8125	44.975	11.62
(ii)	Weighing Cost	25	25	25
(iii)	Packing Cost	20	20	20
(iv)	Loading and unloading Cost	10	10	10
(v)	Cleaning Cost	15	15	25
(vi)	Miscellaneous Cost	3.75	5.25	4
(vii)	Labour Cost	10	10	10
	Total Cost	113.5625	130.225	105.62
3	Producer's net share (%)	67.5775	78.8175	96.45
4	Cost incured by Village Trader			
(i)	Transportation Cost	12.7225	—	—
(ii)	Weighing Cost	4	—	—
(iii)	Packing Cost	20	—	—
(iv)	Loading and unloading Cost	20	—	—
(v)	Commission Charges	15	—	—
(vi)	Miscellaneous Cost	4.75	—	—
	Total Cost	76.4725	—	—
5	Village Trader's Net Margin	269.5825	—	—

6	Cost incured by Wholesaler			
(i)	Transportation Cost	31.065	31.0675	—
(ii)	Weighing Cost	4	4	—
(iii)	Packing Cost	20	20	—
(iv)	Loading & Unloading Cost	20	20	—
(v)	Cleaning Cost	5	5	—
(vi)	Miscellaneous Cost	4.75	5	—
(vii)	Commission Charges	12	12	—
(viii)	Grading Cost	5	5	—
(ix)	Market Cost	3	3	—
(x)	Storing Cost	10	10	—
	Total Cost	114.815	115.0675	—
7	Wholesaler's Net Margin	203.1075	286.7775	—
8	Cost incurred by Retailer			
(i)	Transportation Cost	24.67	24.7675	—
(ii)	Packing Cost	10	10	—
(iii)	Loading & Unloading Cost	20	20	—
(iv)	Miscellaneous Cost	6	7	—
(v)	Labour Cost	25	25	—
(vi)	Market Cost	4	4	—
(vii)	Storing Cost	15	15	—
	Total Cost	104.67	105.7675	—
9	Retailer Net Margin	198.185	327.815	—
10	Retailer's Selling Price to Consumer	3331.67	4558.2675	—
11	Price Spread	1080.395	965.6525	105.62

Marketing Efficiency

Marketing efficiency is the effectiveness with which the market performs its designated function. Table 6 presents the marketing efficiency of rice under the three marketing channels identified in the study. The marketing efficiency was estimated using the Conventional Method, Shepherd's Method and Acharya's Modified Marketing Efficiency Formula. Based on Acharya's method, the efficiency index was found highest in Channel-III (27.26), indicating that this channel was the most efficient due to its lowest marketing cost and minimal price spread. Channel-II recorded a moderate efficiency score of 3.72, while Channel-I showed the lowest efficiency value of 2.09, reflecting higher marketing costs and lower producer share.

The efficiency ranking obtained under Acharya's method, Channel-III (27.26) > Channel-II (3.72) > Channel-I (2.09) is consistent with (Singh and Sonker, 2021) and Singh, Majumdar and Gupta (2020), both of them found that shorter marketing channels with fewer intermediaries consistently outperform longer chains in Uttar Pradesh's rice markets. This pattern also aligns with Biradar (1996), who found in Kolhapur district that price spread and marketing cost increase proportionally with the number of market functionaries involved. The results overall confirm that marketing efficiency decreases as the number of intermediaries increases, and that where a farmer is located within the district shapes both which channels are realistically available and how efficiently they perform.

Table 6: Estimation of marketing performance of different marketing channels

Sl. No.	Particulars	Channel - I	Channel - II	Channel – III
1	Consumer's Price (₹/ Qt.)	3331.67	4558.27	2982.35
2	Total Marketing Cost (₹/Qt.)	409.52	351.06	105.62
3	Marketing Efficiency			
(a)	Conventional Method	2.64	2.75	1
(b)	Shepherds Method	8.14	9.99	28.26
(c)	Acharya's Method	2.09	3.72	27.26

CONCLUSION

The study revealed clear differences in marketed surplus and marketing performance across farm sizes in Banda district. Large and medium farmers contributed the highest marketed surplus, whereas marginal farmers often sold beyond their marketable surplus due to financial pressure. Among the three identified channels, Channel-II was the most commonly used, while Channel-III involved the least marketing cost and ensured the highest producer share in the consumer's rupee (96.45%). Channel-I showed the widest price spread and the lowest producer share because of multiple intermediaries. Based on Acharya's method, Channel-III recorded the highest marketing efficiency (27.26), followed by Channel-II (3.72), whereas Channel-I had the lowest efficiency (2.09). Overall, the findings indicate that shorter channels significantly improve farmers' returns and marketing efficiency compared to channels involving more intermediaries. This is broadly consistent with the wider literature on Indian rice and foodgrain marketing (Alagh, 2014; DES, 2021) and suggests that policy interventions aimed at shortening supply chains such as farmer-

producer organisations, local *haats*, or e-NAM-linked direct sales could meaningfully improve farmer incomes in Bundelkhand, where market infrastructure currently favours multi-tier channels. Promoting shorter marketing chains, strengthening farmer cooperatives, and improving access to real-time market information are recommended as priority measures to enhance marketing efficiency and farmer welfare in the rice sector of the study area.

GENERATIVE AI DECLARATION

The author(s) confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript, and no images were manipulated using AI. The authors developed and verified all scientific content, data analysis, interpretation of results, and conclusions. The authors take full responsibility for the accuracy, integrity, and originality of the work presented, and no AI tool was listed as an author.

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