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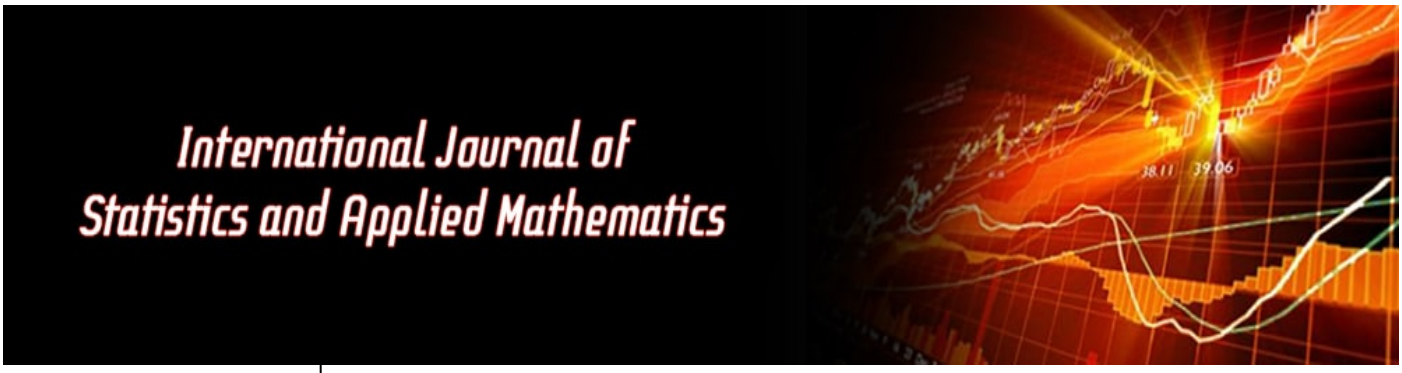

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An economic analysis of growth rate and factors influencing marketable and marketed surplus in wheat and mustard crop in Morena district of Gwalior, Madhya Pradesh

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Abstract
With a special emphasis on the Morena district, this study explores the compound growth rates of the wheat and mustard crop's acreage, production, and productivity over an 18-year span (2000-01 to 2017-18), the study also calculates the marketable and marketed surpluses while examining the variables that affect these surpluses, including family size, land ownership, commodity prices, consumption patterns, and production volumes. The results show encouraging growth rates in crop production and productivity, highlighting the agricultural dynamism of the area. The marketable was found to be highest in wheat followed by mustard. The study also investigates the patterns of farm retention for consumption, seed, feed, salaries, and payments in kind. It emphasizes the volume of crops farmers retain for a variety of uses and the significance of comprehending these patterns of retention for efficient agricultural management.

Keywords: Compound growth rate, marketed surplus, marketable surplus, infrastructure

Introduction
Agriculture plays a vital role in the Indian economy. Agriculture along with fisheries and forestry accounts for one-third of the nation's Gross Domestic Product (GDP) and its single largest contributor. Agricultural exports constitute a fifth of the total exports of the country. In view of the predominant position of the agricultural sector, the collection, and maintenance of Agricultural Marketed and marketable Surplus of food grains assume great importance. In any developing economy, the marketed surplus or producer's surplus of agricultural products plays a significant role. The marketed surplus is, hence, as vital as total production in influencing market prices. It is, thus, very important to have reliable estimates of marketed surplus and recognize vital determinants of marketed surplus to design suitable production, procurement, storage, distribution, and pricing policies. The entire amount of marketable surplus, which is available for sale, may not be actually sold in the market. Therefore, the marketed surplus may be more, less, or equal to the marketable surplus, depending upon the socio-economic conditions of the farmers, the type of the crop, access to the market, etc. Since marketed surplus represents actual sales by farmers, the difference between marketable and marketed surplus can reveal several patterns of sale, purchase, and stockholding by various categories of farmers. If the marketable surplus is higher than the marketed surplus, it indicates that stocks are held by farmers who have better retention capacity in anticipation of fetching higher prices in future periods or sometimes during emergencies (Acharya and Agarwal, 2004) [1].
On the other hand, if marketed surplus and marketable surplus are equal, it indicates that farmers are not in a position to hold back their stocks as they need cash for the next crop or other purposes. The marketed surplus is higher than the marketable surplus when the farmer retains a smaller quantity of the crop than the actual requirements for family, farm, and other needs. The concept of marketed surplus has been used in different ways, and it is necessary to define precisely the term. In some of the earlier studies on food grains marketing in developing countries, three concepts of marketed surplus have been used; gross marketed surplus, net marketed surplus, and marketable surplus.

For the purpose of this study, the marketable surplus has been estimated by subtracting total retention from total production. The arrangement for marketing and the expansion of markets has to be made only for the surplus quantity available to the farmers, and not for the total production. The role at which agricultural production expands determines the pace of agricultural development, while the growth in the marketed surplus determines the pace of economic development.

The agricultural marketing system plays a dual role in the economic development of India where resources are primarily agricultural. Increasing demands for money with which to purchase other goods leads to increasing sensitivity to relative prices on the part of the producer and specialization in the cultivation of those crops on which the profits are the maximum, subject to socio–cultural, ecological, and economic constraints. The marketing system transmits the crucial price signals. An efficient agricultural marketing system leads to the optimization of resource use and output management. An efficient marketing system can also contribute to an increase in the marketable surplus by scaling down the losses arising out of inefficient processing, storage, and transportation. As well, a designed system of marketing can effectively distribute the available stock of modern inputs and thereby sustain a faster rate of growth in the agricultural sector. An efficient marketing system also ensures higher level of income for the farmers by reducing the number of middlemen or by restricting the commission on marketing services and the malpractice adopted by them in the marketing of farm products. The need for providing adequate incentives for increased production is, therefore, very, important and this can be made possible only by streamlining the marketing system.

In India, the total area under mustard and wheat crops during 2017-2018 was 6073.8 thousand hectares, and 29580 thousand hectares, respectively with a total production of 7917.2 thousand tonnes, 9970 thousand tonnes respectively, and productivity of 1304 kg $ha^{-1,}$ 3371 kg ha^{-1}respectively (GOI, 2018). In Madhya Pradesh total area under mustard and, wheat crops during 2017-2018 was708 thousand hectares, and 690 hectares, respectively with a total production of 920 thousand tonnes, and 768 thousand tonnes, respectively, and average productivity was 1299 kg ha^{-1}, 2993 kg ha^{-1}, respectively (GOI, 2018). In Morena district area under mustard and wheat crop during 2017-2018 were 147 thousand hectares and 75 thousand hectares, respectively with production of 336 thousand tonnes, and 350 thousand tonnes respectively, and productivity of 2311 kg ha^{-1}, and 4000 kg ha^{-1}, respectively (GOI,2018).

Research Methodology

The present research work on mustard and wheat crops in the Morena district of Gwalior Madhya Pradesh was based on the following objectives:

1. To study the compound growth rate of area, production, and productivity of mustard and wheat crops in the Morena district, and
2. To estimate the marketable and marketed surplus and farm retention for consumption of seed, feed, wages, and payments in kind.

The secondary data as well as primary data was used in this research work the secondary data were collected through different published sources as well as the Department of Agriculture Statistics of Madhya Pradesh, DDA office, Krishi Vibhag, Morena, (M.P.) The primary data were collected from selected major crop growers (respondents) using a pre-tested questionnaire, through the survey method. The time period of study was from the year, 2000-01 to 2017-18. The study was confined to the Morena block of Morena district as this area had remarkable areas under wheat and mustard crops. For the selection of the sample, a multistage sampling technique namely, the selection of blocks, villages, and farmers was followed. The Morena district comprised 7 blocks i.e., Morena, Porsa, Jaura, Ambah, Kailaras, Sabalgarh, and Pahargarh. In the first stage of sampling Morena block and Porsa block were selected because of the highest production of Mustard and wheat in respective blocks. At the second stage, a block-wise list of villages was prepared. Five villages from each block were selected randomly which forms a sample of 10 villages. In the third stage, a village-wise list of selected crop growers was prepared from each selected village. A total of 160farmers; 80 from each crop *viz*: mustard and wheat, growers were selected from the prepared lists through proportionate random sampling technique by using the formula given below.

$$n_h = \frac{N_h}{N} \times n$$

Where,
n_h = sample size for stratum h
N_h = population size for stratum h
N = total population size
n = total sample size

Analytical tools

Compound growth rates

Compound growth rates of area, production, and productivity of major crops were worked out for the Morena district of Madhya Pradesh during the period 2000-2001 to 2017-18. The compound growth rate was worked out by fitting the exponential function as given below:

$$Y_t = ab^t$$

Where,
Y_t = dependent variable on area, production, and productivity in the year 't'
a = constant,
b = regression coefficient,
t = time element which takes the value 1, 2, 3....n

After transforming the model into a linear form by taking logarithms, we get

$$\text{Log } Y_t = \log a + t \log b$$

By putting Log Y_t= y, log a=A and log b=B, the model becomes linear between y and t, as y = A + Bt, fit the model by the method of ordinary least squares (OLS) technique. The compound growth rate (r) in percent was obtained by the following formula:

$$r = (b\text{-}1) \times 100 = (\text{antilog } b\text{-}1) \times 100$$

The significance of the growth rate was tested by applying the student 't' test statistic

$$T = r/S.E.\ (r)$$

Where,

$$SE\ (r) = sqrt\ [\Sigma\ (Y_i - \hat{y}_i)^2 / (n-2)] / sqrt\ [\ \Sigma\ (x_i - x)^2]$$

Which follows distribution with (n-2) degree of freedom, n is the number of years considered under study. The compound growth rates were computed for the area, production, and productivity of major crops in the Morena district of Madhya Pradesh.

Marketable Surplus

The marketable surplus is computed by the following algebraic formula,

MS = P - C

Where,
MS = Marketable surplus,
P = Gross production in the year,
C =Total requirements in the same year for family use such as consumption (retention + purchase), payment of wages in kind, feed, seed, barter, payment of loan/ irrigation, and physical losses/ wastage in storage/ transportation/ threshing, etc.

Marketed Surplus

In case the quantity actually retained for consumption (and not the quantity actually required for consumption) is taken into account, the quantity calculated is the marketed surplus which is a gross concept, because the quantity sold will not include the buybacks by the producers. The marketable surplus will thus be according to the formula:

A – B = MS

Where,
A stand for production
B includes all the items mentioned

The term "Consumption by the farm family" of the cultivator households refers to the quantity actually retained for consumption by the family irrespective of the actual total requirements for the purpose.

Determinants of Marketed Surplus

A theoretical model of the marketed surplus response function has been used. The marketed surplus of a crop depends on various price and non-price factors. The empirical studies of marketed surplus have found that farmers respond positively to price changes, and this is consistent with economic theory. In addition to price, a number of other socio-economic, institutional, technological, and infrastructural factors influence marketed surplus. Among these are, farm size, the quantity of production, family size, wealth/income, risks, access to markets, market information, etc. A number of studies have reported that there exists a strong linear and, in some cases, a non-linear relationship between the quantity sold and variables like farm size, quantity produced, family size, output prices, and socioeconomic and institutional variables for different categories of farmers.
The linear relation may be written as:

$$MS = \alpha + \beta i\ Xi$$

Where MS denotes the marketed surplus, and Xi (i = 1, 2… n) represents the independent variables influencing marketed surplus.
The dependent variable, marketed surplus (MS), is defined as sales as a share of total output per household. The independent variables include farm size (ha), family size (numbers), awareness about minimum support price (MSP), access to the regulated market, distance to market(km), per household production of the crop (in quintals), sources of off-farm income, access to institutional credit, roads, markets and market information and price received for the produce.

Result and Discussion

In the Morena district of Madhya Pradesh, the average production of mustard during the study period (2000-01 to 2017-18) was 216.61 thousand tonnes. The compound growth rates of production were 4.48 percent per annum. The production of Mustard in Morena district of Madhya Pradesh demonstrated a positive tendency and it was found significant at (1%) level of significance. As regards the productivity of Mustard in the Morena district of Madhya Pradesh, the average productivity during the study period (2000-01 to 2017-18) was 1553.05 kg/hectare. The Compound growth rate was observed at 3.82 percent per annum. The productivity growth rates of mustard in Morena district of Madhya Pradesh demonstrated a positive tendency and it was also significant at (1%) level of significance. In total, the compound growth rate of the production of mustard was higher than its area and productivity.

Table 1: Trends and Growth in Area, Production, and Productivity of Mustard in Morena District

Year	Mustard		
	Area (Thousand ha)	Production (Thousand tonnes)	Productivity (Kg/ha.)
2000-2001	109.7	134.8	1229
2001-2002	125.3	151.2	1207
2002-2003	111.2	88.6	797
2003-2004	135.7	184.5	1359
2004-2005	158.1	202.7	1282
2005-2006	151.1	222.8	1474
2006-2007	146.8	195.4	1331
2007-2008	132.40	186.90	1360
2008-2009	151.40	201	1374
2009-2010	146	219	1600
2010-2011	135	297	2137
2011-2012	154.30	266.10	1720
2012-2013	153	294.70	1892
2013-2014	151	244.20	1596
2014-2015	175.90	167.80	1436

2015-2016	119.20	256.80	1900
2016-2017	121	249.60	1950
2017-2018	147	336	2311
Total	2524.10	3899.10	27955
Average	140.23	216.61	1553.05
CGR (%)	0.85^{NS}	4.48**	3.82**
'b' value	1.00	1.04	1.03

^{NS} Non-significant, **Significant at 0.01 level of probability, *Significant at 0.05 level of probability, Source: DDA Office, Krishi Vibhag, Morena district, Madhya Pradesh

***Source*:** DDA Office, Krishi Vibhag, Morena district, Madhya Pradesh

Trends of Area, Production, and Productivity of wheat in Morena district from 2000-01 to 2017-18

In the Morena district of Madhya Pradesh average area under wheat during the study period (2000-01 to 2017-18) was 83.75 thousand hectares. The compound growth rates evidenced during the study period were 2.27 percent per annum respectively. The area of wheat in Morena district of Madhya Pradesh demonstrated a positive tendency and it was found significant at (1%) level of significance. In the Morena district of Madhya Pradesh, the average production during the study period (2000-01 to 2017-18) was 266.37 thousand tonnes. The compound growth rate of wheat production was 5.22 percent per annum.

The production of wheat in Morena district of Madhya Pradesh demonstrated a positive tendency and it was found significant at (1%) level of significance. As regards the productivity of wheat in Morena district of Madhya Pradesh the average productivity during the study period (2000-01 to 2017-18) was 3132.44 kg/hectare. The compound growth rate observed was 1.78 percent. The productivity growth rates of wheat in Morena district of Madhya Pradesh demonstrated a positive tendency and it was also significant at (1%) level of significance. In total, the compound growth rate of production of wheat was higher than its area and productivity.

Table 2: Trends and Growth in Area, Production, and Productivity of wheat in Morena district

Year	Wheat		
	Area (thousand ha)	**Production (thousand tonnes)**	**Productivity (Kg/ha.)**
2000-2001	75.6	218.3	3008
2001-2002	67	181.5	2824
2002-2003	66.6	150.3	2352
2003-2004	71.9	210.4	3046
2004-2005	67.8	207.3	3184
2005-2006	68.2	216.8	3312
2006-2007	75.2	221.9	3071
2007-2008	78.3	159.8	3071
2008-2009	80.4	184.8	2126
2009-2010	81.5	179.8	2396
2010-2011	96	221.8	2298
2011-2012	104	412	3959
2012-2013	101	382	3801
2013-2014	95	400	3164
2014-2015	125	378	3022
2015-2016	99	420	4250
2016-2017	80	300	3500
2017-2018	75	350	4000
Total	1507.5	4794.7	56384
Average	83.75	266.37	3132.44
CGR (%)	2.27**	5.22**	1.78*
'b' value	1.02	1.05	1.01

^{NS} Non-significant, **Significant at 0.01 level of probability, *Significant at 0.05 level of probability, Source: DDA Office, Krishi Vibhag, Morena district, Madhya Pradesh

Marketable and marketed surplus of Mustard and Wheat crops in Morena

In the estimation of marketable and marketed surplus, sale price, information regarding marketed surplus and sale pattern, and realized price related to selected crops i.e., mustard and wheat have been analyzed and dealt with in this subhead. Information regarding marketed surplus has been analyzed for mustard and wheat and is shown in Table 3.

Overall, on the sample farms the total per-farm production of mustard and wheat was 6294 quintals, and 11603 quintals, respectively. The marketed surplus accounted for mustard and wheat was 2911 quintals, and 3536 quintals, respectively. On average, mustard and wheat, received a selling price of Rs. 4014, and Rs. 1977, respectively. The mustard and wheat accounted for 3096 quintals and 6141 quintals.

Table 3: Total production, marketed surplus, selling price, and storage of mustard and wheat crops on a Farm basis in Morena district.

Crops	Total production (qtl)	Marketed surplus (qtl)	Selling price (Rs/qtl)	Storage(qtl)
Mustard	6294	2911	4014	3096
Wheat	11603	3536	1977	6141

Production, requirement, marketable surplus, and marketed surplus of major crops (Farm basis)

Marketable surplus is the total requirement of the farmers. It is observed from the data that the maximum average total production, family consumption, seed, and feed was recorded as 223.69quintals, 8.3 quintals, 11.39 quintals, and feed 1.45 quintals, respectively. The total requirement was recorded as 21.14 quintals. There was no requirement for the wages (Table 4). It is observed from the data that the marketed surplus of mustard and wheat was found to be less than the marketable surplus. Marketable surplus of mustard and wheat was initiated to be maximum in wheat 126.26 quintals followed by mustard 76.29 quintals. The marketed surplus of mustard and wheat was initiated to be maximum in wheat 44.19 quintals and in mustard it was 36.38 quintals.

Table 4: Production, requirement, marketable surplus, and marketed surplus of major crops (Farm basis)

Crops	Total Production	Requirement				Total Requirement	Marketable Surplus	Marketed Surplus
		Family consumption	Seed	Feed	Wages			
Mustard	78.66	0.35	1.69	0.33	00	2.37	76.29	36.38
Wheat	145.03	7.95	9.7	1.12	00	18.77	126.26	44.19
	223.69	8.3	11.39	1.45	00	21.14	202.55	80.57

Estimation of farm retention for consumption seed, feed, wages, and other payments in kind

Farm retention pattern related to selected crops (mustard and wheat) has been analyzed and shown in Table 5. The retention consists of quantity kept for family consumption, seed, feed, wages, and payments in kind laborers, gifts, and others. The total retention was found to be 21.14quintals of mustard and wheat for family consumption, seed, feed, wages, and payments in kinds. Out of which the average of seed 11.39quintals was found to be the highest followed by family consumption of 8.3 quintals and feed 1.45quintals. There are no wages and payments in kind, respectively.

An average mustard grower was found to retain 2.37 quintals of mustard for family consumption, seed, feed, wages, and payments in kind, out of which the average of seed 1.69 quintals was found to be highest followed by family consumption of 0.35 quintals and feed 0.33 quintal. There are no wages and payments in kind, respectively.

An average wheat grower was found to retain 18.77 quintals of wheat for family consumption, seed, feed, wages, and payments in different kinds. Out of which the average of seed 9.7 quintals was found to be the highest followed by family consumption 7.95 quintals and feed 1.12 quintals. There are no wages and payments in kind, respectively.

Table 5: Crops Retention Pattern of selected crops in Morena district (qtl.)

Crops	Family consumption	Seed	Feed	Wages	Payments in kinds	Total retention
	1	2	3	4	5	(1 to 5)
Mustard	0.35	1.69	0.33	00	00	2.37
Wheat	7.95	9.7	1.12	00	00	18.77
All Crops	8.3	11.39	1.45	00	00	21.14

Factor influencing marketable and marketed surpluses

Appreciating the behaviour of marketed surplus and factors influencing it can help in designing sound policies related to agricultural marketing, pricing, buffer stocks, market infrastructure, etc. The marketable surplus of a crop depends on various price and non-price factors such as the accessibility of cultivated land under the crop, family size, income, risk, and uncertainties. In order to identify the pattern of the marketed surplus of mustard and wheat, and variables influencing it, data collected during investigation from Morena for two major crops *viz*., mustard and wheat, from 2000-01 to 2017-18 was used. The predictable regression parameters of the marketed surplus model are shown in Table 6. As estimated, variables like the size of family (no.), size of land holding, size of the area under crops, price of the commodity (Rs/qtl.), consumption habit (qtl), total production, nature of commodity and requirements for seed/feed/wages as an independent variable by using multiple regression model.

It was observed from the data that the fitted function for mustard was found to be a good fit as the coefficient of multiple R-values was 7 percent discovered that the fitted function able to explain more identified independent variables. Amongst all the independent variables i.e., total production was found to be positive and significant. The independent variables like the price of the commodity (Rs/qtl.) were found to be negative and significant. The independent variables like the size of land holding, size of the area under crops, consumption habit (qtl.), and Requirements for seed/feed/wages were also found non-significant, and the size of the family (no.) was found to be negative and non-significant.

It is observed from the data that the fitted function for wheat was found to be a good fit as the coefficient of multiple R -value was 64 percent discovered that the fitted function able to explain more identified independent variables. Amongst all the independent variables i.e., size of family (no.), size of land holding, size of the area under crops, consumption habit (qtl.), total production, and Requirements for seed/feed/wages were also found positive and significant. The price of the commodity (Rs/qtl.) was found to be non-significant.

Table 6: Factors influencing marketed surplus

Variables	Mean value	S.D.	'r' value
Mustard			
Size of family (no.)	2.030	0.227	-0.061^{NS}
Size of land holding (ha)	4.621	0.517	0.054^{NS}
Size of area under crops (ha)	4.621	0.517	0.054^{NS}
Price of the commodity (Rs/qtl)	163.061	18.231	-0.309**
Consumption habit (qtl)	1.147	0.128	0.103^{NS}
Total production (qtl)	102.649	11.477	0.714**
Requirements for seed/feed/wages (qtl)	1.310	0.146	0.091^{NS}
(Coefficient of Multiple regression) R	**0.0786**		
Wheat			
Size of family (no.)	2.863	0.320	0.386**
Size of land holding (ha)	3.956	0.442	0.582**
Size of area under crops (ha)	3.956	0.442	0.582**
Price of the commodity (Rs/qtl)	72.717	8.130	0.052^{NS}
Consumption habit (qtl)	3.058	0.342	0.411**
Total production (qtl)	158.978	17.774	0.600**
Requirements for seed/feed/wages (qtl)	5.310	0.594	0.395**
Coefficient of multiple regression) R	0.6437		

^{NS} Non-significant, **Significant at 0.01 level of probability

Conclusions

It can be concluded from the above results that the growth in the production of wheat was contributed by both growth in its area and productivity whereas, in the case of mustard the growth in production was mainly contributed by growth in its productivity. Marketable surplus was greater in mustard and wheat than its marketed surplus.

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