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**Dynamics of Agricultural Price Variation across States: A case of
Paddy Cultivation in India**
WORKING PAPER

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Abstract

The markets for agricultural crops have always been segmented. Although agricultural price policy in India is largely focused around declaring minimum support price (MSP) for select crops at all India level the price for any crop has hardly been unique for the country. Since Agriculture is a state subject most of the policies related to agriculture sector and particularly affecting agriculture prices are largely state specific. In this context the paper tries to understand how far prices of paddy has been different across states. To what extent such price policies are instrumental in the determination of actual price differentials realised by farmers across states. Besides, the attempt has also been made to explore major correlates instrumental in creating differentials in the prices across states. The paper draws its analysis based on unit level data of National Sample Survey 77th round on the situation assessment of farmers (2018-19). The paper evaluates some of the possible factors such as government procurements of paddy, land ownerships patterns, percentage of farmers selling in the regulated markets etc. in the context of price determination of paddy. Further, the paper also tries to find the link between local market prices and price in the regulated markets in different states.

Key words- Agricultural Prices, Government procurement, Minimum Support Price, JEL- Q11, Q13, Q130

Agricultural price policy in India is largely attributed to fixation of minimum support prices (MSP) of various crops. The primary objective of agricultural policy (MSP) is to identify and fix a set of prices of agricultural produce by ensuring basic viability of the agricultural operation (GOI 2006). Government fix MSP primarily based on changing cost of cultivation of concerned crops. The cost of cultivation is generally calculated by Commission of Agricultural Cost and Price¹. However, only government agencies and government regulated markets such as Agricultural Produce Marketing Committee (APMC) etc. ensures at least MSP to farmers selling in those markets officially. No private selling agencies is legally bound to give MSP to farmers for their produce (Singh & Bhogal 2021). Besides, agriculture is a state subject in India and farming conditions varies substantially across states, the prices of crops are expected to be different across states despite the announcement of MSP at the pan India level. Besides, since a part of agricultural produce is consumed locally and it is perishable in

¹ For details about the methods of determination of MSP see GOI (2015a) and GOI (2015b)

nature, the transportation of crops from one region to another happens to be insufficient to reduce price gaps across states substantially.

Government procurement and operation of the government regulated market has been skewed across states (Mohankumar & Premkumar 2018). In this backdrop this paper firstly, tries to track the pattern of average agricultural prices for paddy across states in India and secondly it also aims to identify set of factors responsible for such price variation across states. In doing so the paper tries to explain how agricultural policy in India particularly in the context of fixation of MSP and the procurement through the regulated markets have been instrumental in determination of price and variation therein across states. The study is also extended to find out how regulated market prices affects local market price and create divergence of price received by farmers across states. Further some other factors such as land distribution, production and yields of crops etc. also explored in this context.

The selection of paddy is based on fact that overwhelming proportion of farmers are engaged in the cultivation of paddy and the cultivation is spread over almost all the major states of the country. The analysis is based on the 77th round of National Sample Survey Organisation (NSSO) data based on the survey conducted during 2018-19. The price in this paper is the rate of paddy received by the individual farmer which is calculated from the unit level data. In the entire paper, gross farms are taken as a unit of analysis². As far as states are concerned this paper includes seventeen major paddy producing states namely Andhra Pradesh (AP), Assam (ASSM), Bihar (BIH), Chhattisgarh (CHHAT), Gujarat (GUJ), Haryana (HAR), Jharkhand (JHAR), Karnataka (KAR), Kerala (KER), Maharashtra (MAH), Madhya Pradesh (MP), Odisha (ODISH), Punjab (PUN), Telangana (TEL), Tamil Nadu (TN), Uttar Pradesh (UP), and West Bengal (WB). Section I of this article deals with procurement agencies and their role in overall procurement from farmers; section two incorporates patterns of price differentials across states; section four is dealing with Principal Component Analysis for identifying a set of relevant factors affecting the price variation across states; section five tries to understand various correlates of price different across states and this section is followed by some concluding remarks at the end of the paper.

Section I: Procurement agencies and farmers selling pattern across states

Broadly, NSS data record procurement agencies as local market, Input dealer, private food processing units, contract farming agencies as part of non-price regulated agencies. Within

² a single unit of agricultural cultivation units is treated as one gross farm or farmers. Same unit can be used for the cultivation of paddy twice or more during the same year in different seasons and therefore counted as many times as the cultivation of paddy is done during the entire agricultural year.

these non-regulated agencies, local market constitutes significant proportion of total sale by farmers. On the other hand, cooperatives, APMC, Government agencies and Farmers Producer's Organisation are procurement agencies largely considered as price regulated procurement agencies in which MSP is applicable. While, in all other agencies, as the system of MSP is not legally binding for private players, the price offered to the farmers are broadly market determined (Narayanmurthi 2021).

Table 1: Distribution of procurement by agencies across states

State	Local market	APMC	Input dealer	cooptative	Govt agency	FPOs	Private processor	Contract farming	other
AP	78.85	0.79	6.27	0.48	3.86	0.01	8.77	0.00	0.98
ASSM	88.44	0.00	1.05	0.00	0.00	0.22	3.95	1.11	5.23
BIH	89.96	0.87	1.32	0.98	0.99	0.01	3.12	0.00	2.75
CHHAT	26.23	1.22	0.94	43.98	26.44	0.00	0.06	0.01	1.13
GUJ	76.39	0.95	1.01	0.16	0.00	0.00	20.68	0.00	0.81
HAR	48.09	35.52	0.53	0.00	7.95	0.00	7.28	0.23	0.40
JHAR	97.69	0.23	0.75	0.14	0.56	0.00	0.52	0.00	0.11
KAR	91.86	3.41	0.31	1.38	0.00	0.00	3.00	0.00	0.05
KER	21.12	0.00	0.00	2.12	67.14	0.00	0.48	4.03	5.11
MAH	63.49	3.21	0.23	2.43	2.79	0.12	12.49	0.00	15.24
MP	65.11	8.98	0.75	16.15	6.89	0.00	1.40	0.00	0.71
ODISH	68.11	0.41	7.27	10.46	9.53	0.07	0.74	0.18	3.23
PUN	51.99	10.86	0.63	0.00	24.30	0.00	0.00	11.88	0.34
TEL	35.75	9.73	2.38	2.64	39.60	0.14	5.71	0.12	3.92
TN	70.56	1.63	0.08	5.03	15.37	0.00	6.34	0.00	0.99
UP	88.15	1.00	3.04	0.15	2.86	0.00	2.27	0.01	2.52
WB	87.43	1.09	1.43	0.71	3.12	0.55	4.13	0.00	1.54

Source: Authors calculations from the unit level NSSO data on "Situation Assessment of Agricultural Households and Land and Holdings of Households in Rural India 2019", NSS 77th Round (January – December 2019).

Table 2: Production (Paddy) related indicators across select states

state	Yield	Gini land	Production 2018-19 (In LMT)	Production 2017-18 (In LMT)	Change in Production 2017-19 (In %)	Standard Deviation (Average Price)
AP	3729	0.44765	82.35	81.66	0.84	2.49

ASSM	2153	0.36464	52.20	52.84	-1.21	1.9
BIH	1948	0.4471	61.55	80.93	-23.95	8.5
CHHAT	1810	0.3993	65.27	49.31	32.37	4.5
GUJ	2279	0.4257	19.12	18.91	1.11	3.75
HAR	3121	0.58415	45.16	45.23	-0.15	1.81
JHAR	1895	0.388	28.94	40.78	-29.03	1.76
KAR	3012	0.4665	34.31	30.17	13.72	4.65
KER	2920	0.5121	5.78	5.21	10.94	4.780
MAH	2236	0.4064	32.76	27.31	19.96	5.79
MP	1880	0.4291	44.95	41.24	9.00	3.57
ODISH	2004	0.3776	77.34	65.51	18.06	1.84
PUN	4132	0.53	128.22	133.82	-4.18	5.21
TEL	3452	0.4593	66.70	62.62	6.52	2.01
TN	3562	0.4014	61.31	66.39	-7.65	3.03
UP	2704	0.4962	155.45	132.74	17.11	3.37
WB	2926	0.4431	162.42	149.67	8.52	1.93

Source: Authors compilation

Note: Gini land and Standard Deviations are calculated from NSS 77th round unit level data for paddy cultivation. Production and Yield details are compiled from – Ministry of Agriculture data base³

Table 3: Government Procurement and Price related indicators across select states.

State (1)	Govt Proc (2)	Proc/prod (3)	per_ farm_ reg (farms in %) (4)	per_ farm_reg (quant) (5)	Average Price (6)	Market price (7)	Regulate d price (8)	At least MSP (9)
AP	48.06	58.36	5.13	10.37	15.78	15.90	16.11	15.17
ASSM	1.02	1.95	0.22	9.48	13.26	13.49	13.07	1.59
BIH	9.49	15.42	2.85	24.12	14.36	14.31	15.48	3.48
CHHA T	39.71	60.84	71.64	116.57	20.02	15.15	23.36	60.46
GUJ	0.09	0.47	1.11	161.53	16.15	16.47	15.89	24.45
HAR	39.42	87.29	43.47	64.68	24.82	24.70	25.10	72.7
JHAR	1.52	5.25	0.93	4.61	13.69	13.74	18.70	4.03

³ [https://eands.dacnet.nic.in/PDF/Agricultural%20Statistics%20at%20a%20Glance%20-%202020%20\(English%20version\).pdf](https://eands.dacnet.nic.in/PDF/Agricultural%20Statistics%20at%20a%20Glance%20-%202020%20(English%20version).pdf)

KAR	0.59	1.72	4.79	158.94	16.11	16.45	14.98	29.7
KER	4.65	80.45	69.26	38.50	21.85	18.78	24.23	82.32
MAH	5.80	17.70	8.56	29.85	18.69	19.25	19.03	54.9
MP	13.95	31.03	32.02	83.34	16.62	17.58	18.93	33.42
ODISH	44.48	57.51	20.47	26.39	14.00	13.53	17.12	10.86
PUN	113.34	88.39	35.17	38.59	19.61	18.36	17.70	70.6
TEL	51.90	77.81	52.11	104.35	17.15	16.60	17.53	63.26
TN	12.94	21.11	22.03	63.40	16.19	16.12	16.27	28.97
UP	32.33	20.80	4.00	23.74	15.13	15.90	20.00	12.52
WB	19.79	12.18	5.47	26.32	14.36	13.99	16.52	8.21

Source: same as table 1 (except column 2 and 3)

Note: column 2 (Govt proc) shows absolute quantity procured by government agencies during 2018-19 in lakh million tone⁴; column 3 (Proc/prod) shows government procurement as a percentage of total production⁵ of the state; column 4 (per_farm_reg (farms in %)) shows percentage of farmers reported to sell in the regulated markets combined together; column 5 (per_farm_reg (quant)) shows the reported total quantity sold in the regulated market as a percentage of total government procurement in respective states; column 6 (Average Price) shows the average price received by farmers from all sources of procurement; column 7 (Market Price) shows the local market price received by farmers; column 8 (Regulated Price) shows the average price received by farmers in regulated markets; column 9 (At least MSP) shows the percentage of farmers selling at a price at least equal to the MSP announced for 2018-19.

Table 1 shows the percentage of farmers selling their produce to various procurement agencies across states. The distribution is far from homogenous and in some states like Kerala, Chhattisgarh, and Telangana overwhelming proportion of farmers sold their produce in the regulated markets like APMC, cooperatives or to government agencies. For some states like Haryana and Punjab, the ratio of farmers selling in to regulated market is reasonably high. For all other states, proportion of farmers selling into the non-regulated markets is quite high and within that the ratio for local market is overwhelming. In fact, the proportion of farmers selling in the non-regulated market goes as high as more than 99 percent (nearly 98 percent for local market alone) in case of Jharkhand. For some other states like, Bihar, Assam, Karnataka, Uttar Pradesh, and West Bengal this ratio was observed to be extremely high. As far as contract farming is concerned, Punjab witnessed around 12 percent of paddy farmers selling their produce under the contract while in all other states the presence of contract farming is dismal. In Gujarat and Maharashtra, farmers are reported to sell directly to the private food processors units are relatively higher as compared to other states. Thus, it is clear from the table that

⁴ https://fci.gov.in/app/webroot/upload/Procurement/1Rice%20proc.%20last%2010%20yrs_15.pdf

⁵ Production details are taken from Table 2 and then the ratio is calculated for the year 2018-19.

farmers in most of the states are relying more on non-regulated markets particularly on local markets for selling their produce, while very few states like Kerala, Chhattisgarh, Telangana, Haryana, and Punjab the presence of regulated markets is relatively higher.

One of the important factors affecting farmers selling in the regulated market is the availability of government procurement. In terms of absolute quantity, the procurement has been highly skewed across states. Six states namely Punjab (25.53 %), Telangana (11.69 %), Andhra Pradesh (10.82 %), Odisha (10.02 %), Chhattisgarh (8.94 %), and Haryana (8.88 %) constitute nearly 76 percent of total paddy procurement of the country (Table 3). However, their contribution in the production of paddy in the country remained less than 40 percent. More precisely, for some states like Punjab (88.39 %), Haryana (87.29 %), Kerala (80.45), Telangana (77.81 %), Chhattisgarh (60.84 %), Andhra Pradesh (58.36%), and Odisha (57.5 %) the percentage of total government procurement out of total production of paddy was very high while for states such as Gujarat (0.47 %), Assam (1.95 %), Karnataka (1.72 %), Jharkhand (5.25 %), Bihar (15.42 %), and Maharashtra (17.7 %) the ratio of procurement to production was very low. Sure enough, the government procurement in states has been highly skewed in terms of both absolute quantity of procurement and the share of production across states. This has obvious bearing on the percentage of farmers selling in the regulated markets as both cooperatives and direct government procurement has been one of the most important parts of entire regulated markets.

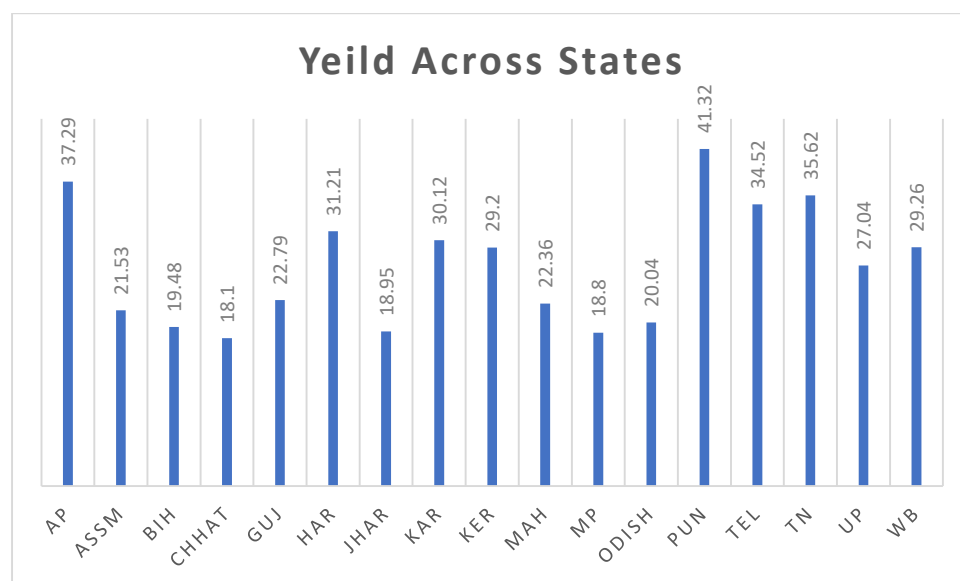
The states with higher percentage of government procurement to production shows higher percentage of farmers selling in the regulated markets. Though this relationship seems trivial, they are more complex. There are two possibilities due to which such straight relationship might not be present as expected. Firstly, if in any states a proportion of large farmers is higher and they are the one selling primarily into the regulated market then despite high procurement to production ratio, percentage of farmers selling in the regulated market might not be higher. Secondly, if middlemen are active in the states and they might be involved in purchasing paddy from the farmers at relatively lower than MSP price and they sell those procured paddy into the regulated markets. The percentage of total sale of paddy in quantity out of total reported government procurement (Table 2) shows that in case of Jharkhand (4.61 %), assam (9.48 %), and Andhra Pradesh (10.37 %), the total quantity sold in the regulated markets⁶ as reported by farmers⁷ constitute smaller portions of total procurement. This means that large proportions of

⁶ Her regulated markets refer to APCI, Cooperatives, FPOs, and Government agencies combined.

⁷ Total quantity sold to regulated markets by farmers as reported in the NSSO data are aggregated for the states.

government procurements are happening from non-farmers or middlemen in these states. However, on the other hand for some states like Karnataka, Gujarat, Chhattisgarh, and Telangana this ratio is well above 100 percent⁸ which to a large extent confirm that most of the government procurement in those states are happening from the farmers directly. Here, the case of Karnataka and Gujarat is not much of importance because government procurement in the state has been meagre and only small proportions of farmers are selling in the regulated market. However, for Chhattisgarh and Telangana with higher procurement- production ratio and with higher percentage of farmers selling in the regulated markets, necessarily implies that government procurement is overwhelmingly happening from farmers directly. In all other states there has been moderate gaps between government procurement and farmers reported quantity of selling in the regulated markets confirms that government procurement is happening from both farmers and middlemen in those states. To what extent such gaps affects prices across states will be evaluated in later part of the paper.

Figure 1: Yield of Paddy across states in 2018-19



Source: Table 2

Section II: Understanding the structure of Price differentials across States

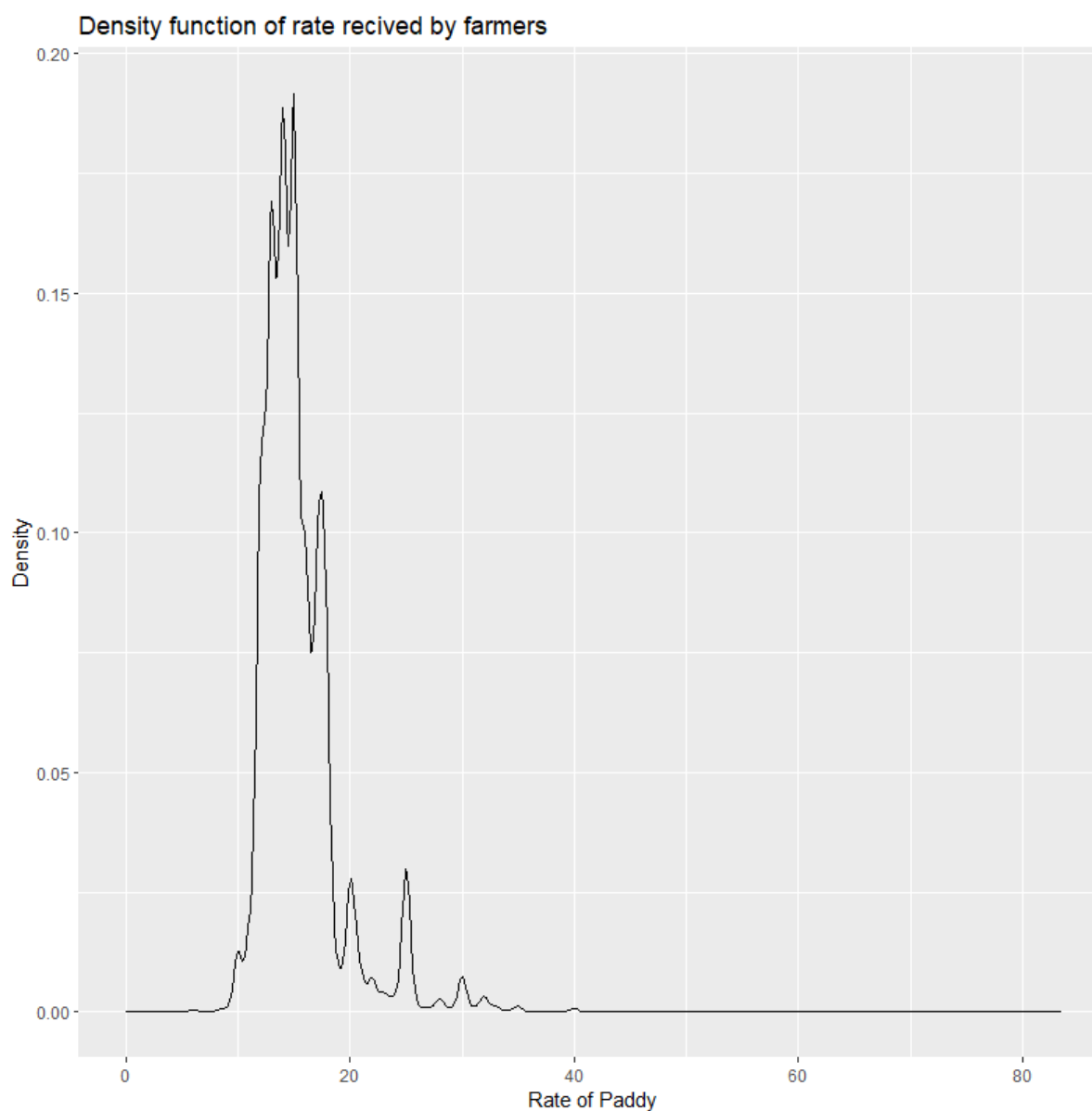
Before going into the details of state specific price it is important to understand the structure of prices at the national level. The Figure 3 shows that the country is far from having a unique

⁸ The ratio is higher than 100 percent may be because other regulated markets constitute relatively major part of procurement.

price although the agricultural price policies are based on single procurement price⁹ at pan India level. The figure confirms the presence of at least eight peaks (for price of paddy) ranging from as low as 15 to as high as 30 rupees per kg. Since agricultural markets are segmented across states and procurements are also a function of state policies, one can suspect that such variation could have some overlapping with the states.

Figure 2: Density function of Average price Received by farmers in 2018-19 for all states together

⁹ Some states offer some bonus over the nationally declared MSP as part of state's own intervention in the agriculture sector. However, largely the government procurement price remains similar across states. The difference in the prices within the regulated markets comes largely in the APCI markets where bargaining plays an important role in the determination of final price and price also varies significantly from farmer to farmers and therefore not similar across states.



Source: Same as Table 1

To understand that whether average price of paddy is not the same across states, ANOVA test is done, and results (Table 4) confirms that for all states average prices of paddy is not the same. The F values are completely significant.

Table 4: The ANOVA results for testing Unique price for all states

	Df	Sum Sq	Mean Sq	F value Pr (>F)
state	16	236440818	14777551	698.3 <2e-16 ***
Residuals	25054	530188222	21162	

Source: Same as Table 1

Note: Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 5 Shows that average prices of paddy are different for majority of the states in pairs. There are few pair of states such as Punjab and Chhattisgarh, Jharkhand and Odisha, Gujarat and Maharashtra, Andhra Pradesh and Gujarat, Karnataka and Madhya Pradesh, Karnataka and Andhra Pradesh, Tamil Nadu and Madhya Pradesh and Tamil Nadu and Andhra Pradesh which show not very different average prices. Going beyond statistical significance, following table indicates that average prices are high and not different in Punjab and Chhattisgarh, very low and not very different for Jharkhand and Odisha and for Gujarat, Karnataka, Madhya Pradesh, Andhra Pradesh, and Tamil Nadu are reasonably similar with medium values. All other pair of states the average prices are showing statistically (significant) different to each other.

Table 5: Pairwise difference in the average price across states with p values of their differences (ANOVA test results)

State	PUN	HAR	UP	BIH	ASSM	WB	JHAR	ODISH	CHHAT	MP	GUJ	MAH	AP	KAR	KER	TN	TELE
PUN	#N/A	5.22	4.48	-5.24	-6.34	-5.24	-5.91	-5.61	0.42	2.98	3.46	0.92	3.82	-3.5	2.24	3.42	2.45
HAR	0	#N/A	-9.7	10.46	11.56	10.46	11.13	-	10.82	-4.8	-8.2	8.67	6.14	9.04	8.71	2.98	8.63
UP	0	0	#N/A	-0.76	-1.87	-0.76	-1.43	-1.13	4.9	1.5	1.02	3.56	0.66	0.98	6.72	1.06	2.03
BIH	0	0	0	#N/A	-1.1	0.002	-0.67	-0.37	5.66	2.26	1.78	4.32	1.42	1.75	7.48	1.82	2.79
ASSM	0	0	0	0	#N/A	1.1	0.43	0.74	6.76	3.36	2.89	5.42	2.52	2.85	8.58	2.93	3.89
WB	0	0	0	1	0	#N/A	-0.67	-0.36	5.66	2.26	1.78	4.32	1.42	1.75	7.48	1.83	2.79
JHAR	0	0	0	0	0.052	0	#N/A	0.3	6.33	2.93	2.45	4.99	2.09	2.42	8.15	2.49	3.46
ODISH	0	0	0	0.0054	0	0.0034	0.54	#N/A	6.02	2.63	2.15	4.69	1.79	2.11	7.85	2.19	3.16
CHHAT	0.425	0	0	0	0	0	0	0	#N/A	-3.4	3.88	1.34	4.24	3.91	1.82	3.83	2.87
MP	0	0	0	0	0	0	0	0	0	#N/A	0.48	2.06	0.84	0.51	5.22	0.43	0.53
GUJ	0	0	0	0	0	0	0	0	0	0.54	#N/A	2.54	0.36	0.04	5.7	0.04	1.01
MAH	0	0	0	0	0	0	0	0	0	0	0	#N/A	-2.9	2.58	3.16	-2.5	1.53
AP	0	0	0	0	0	0	0	0	0	0	0.87	0	#N/A	0.33	6.06	0.41	1.37
KAR	0	0	0	0	0	0	0	0	0	0.33	1	0	0.922	#N/A	5.74	0.08	1.04
KER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	#N/A	-	-
TN	0	0	0	0	0	0	0	0	0	0.32	1	0	0.297	1	0	#N/A	0.96

TEL	0	0	0	0	0	0	0	0	0	0.054	0	0	0	0	0	0	#N/A
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Source: Same as Table 1

Note: lower left part of the diagonal part shows the p values of pair wise difference in average price and upper right of the diagonal shows the absolute pair wise difference in average price.

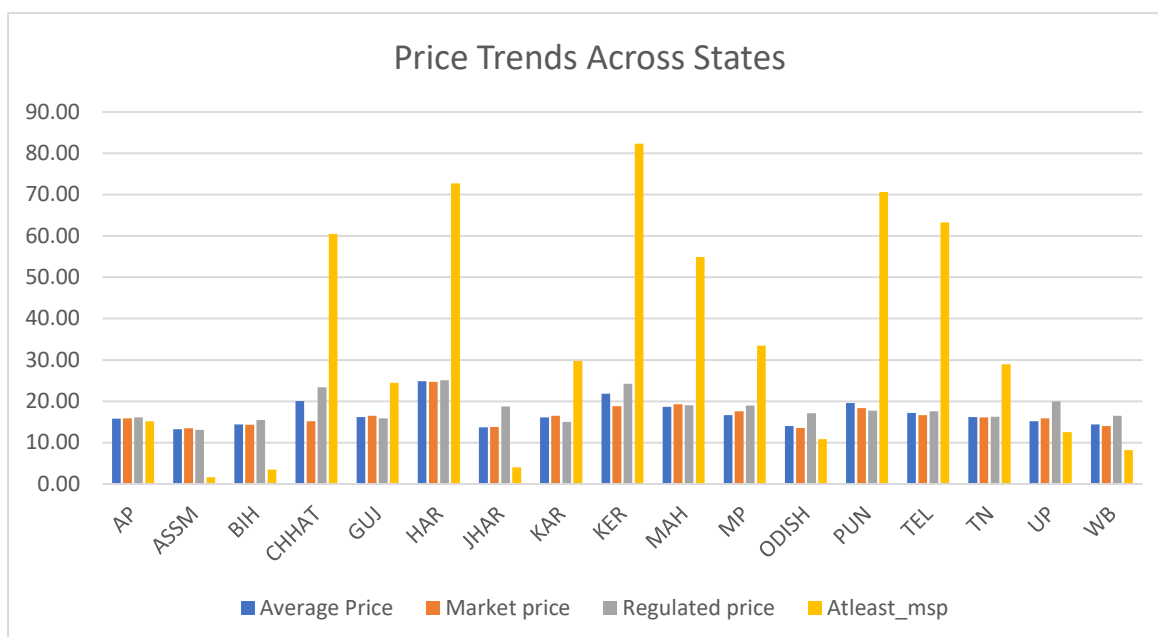
Given the fact that average prices received by farmers differs across states it is important to understand characteristics of such differences. The extent of price difference can be shown by the fact that the average price of paddy in Haryana (with highest average price) was more than 87 percent higher (Table 3 and Figure 3) than that of Assam (with lowest average price). Some states like Haryana, Chhattisgarh, Kerala, Maharashtra and Punjab, the average price received by farmers has been higher and reported to be either 20 rupees per kg or above. While in some states like Assam, Jharkhand, Bihar, Odisha, Uttar Pradesh and West Bengal, the average price received by farmers has been substantially lower than the national average. Such clustered price difference across states indicates that some common factors might be in existence (or in absence) which could be instrumental in creating gaps in average price of paddy in such cluster of states.

It is also an imperative to understand how different procurement agencies offer prices of paddy to farmers in various states. Local market prices are generally treated as free market prices which could be a function of demand and production of the food grain. On the other hand, regulated market (such as APMC, Cooperatives, Government agencies and FPOs) offer price are largely guided by MSP fixed by the government from time to time¹⁰. It is also important to look at the fact that whether price offered in the regulated market are different than the local market prices on an average basis. Figure 1 and Table 2 clearly show that in most of the states average price in the regulated market¹¹ are either higher or nearly equal to the local market prices, except for a few states like Assam, Gujarat, Karnataka, and Punjab (to a smaller extent Maharashtra also) where the reverse pattern is observed.

Figure 3: The Trends of Average Price of Paddy received by farmers across Select States

¹⁰ However, difference in prices in both regulated and non-regulated markets also depends on some other factors such as - timing of sale, site, volume, grading, quality assessment, price determination, weighing method, and timing and mode of payment (Chatterjee et al 2020), nevertheless these factors are not expected to explain average price differentials across states.

¹¹ Here regulated market price is the average price received by farmers in any state averaged over all regulated procurement agencies such as APCI, government Procurement, Cooperatives and FPOs.



Source: Authors calculations from the unit level NSSO data on “Situation Assessment of Agricultural Households and Land and Holdings of Households in Rural India 2019”, NSS 77th Round (January – December 2019).

The average price in the regulated market is substantially higher as compared to local market prices in states like Chhattisgarh, Jharkhand, Kerala, Odisha, Uttar Pradesh, and West Bengal. A detail picture of price variation across as well as within the states for paddy is shown in the Figure 4. Box plot of prices (Figure 4) confirms that not only the average price of paddy is higher for some states like Haryana, Punjab, Chhattisgarh, and Maharashtra than the other states, but the proportion of farmers getting higher prices in these states has also been significantly higher as well.

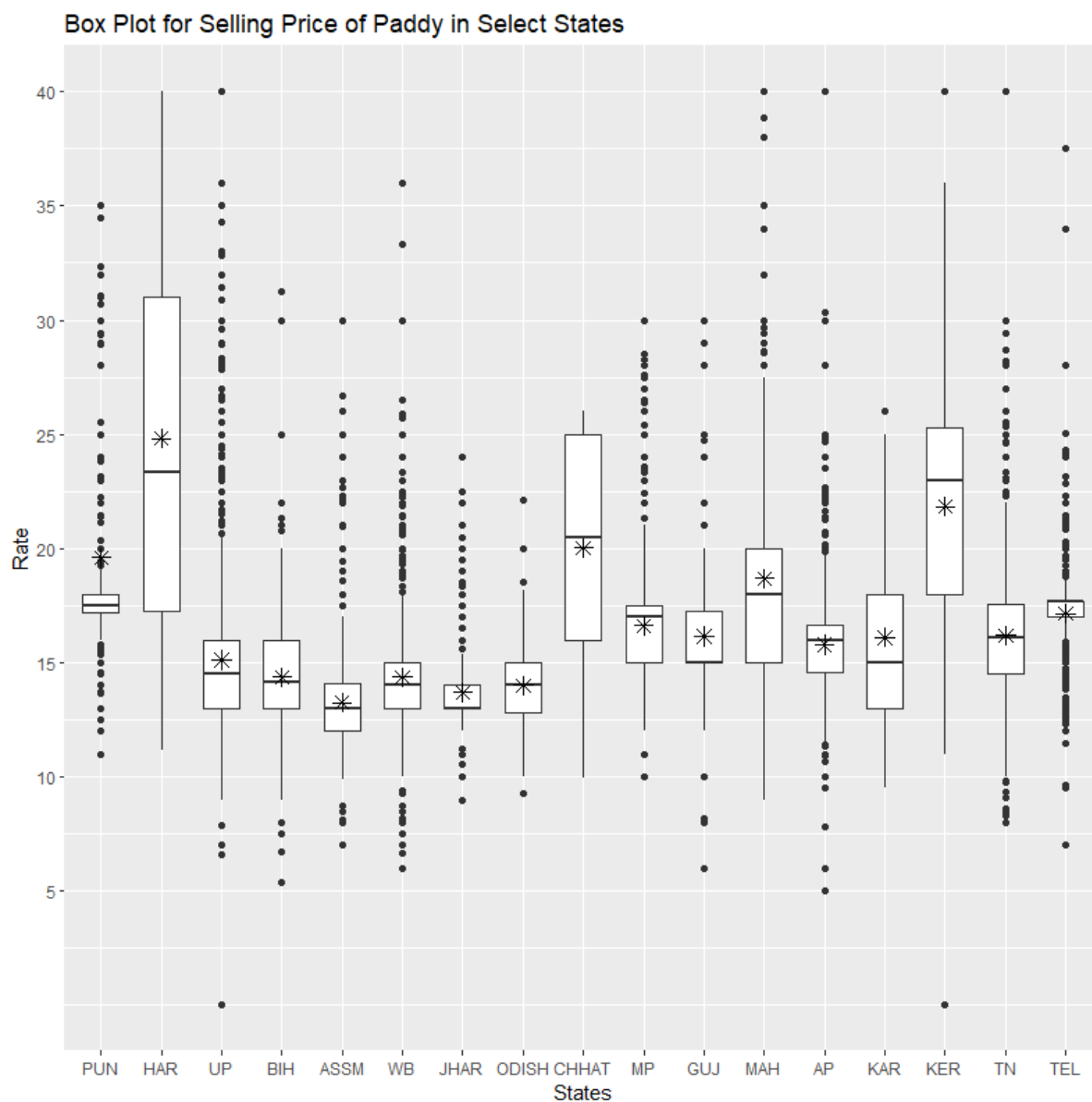
In this context it is important to see how minimum support price fixed by government works for these states. For the year 2018-19, the minimum support prices were fixed at 17.5 rupees per kg for normal variety and 17.7 for higher variety of paddy. Now taking the conservative estimates with 17.5 rupees per kg the proportion of farmers getting at least MSP has been highly skewed across states. For states with high average prices shows higher proportion of farmers getting at least MSP. For instance, in Chhattisgarh (above 60 percent), Haryana (above 72 percent), Kerala (above 82 percent), Maharashtra (around 55 percent), Punjab (above 72 percent) and Telangana (above 63 percent), the proportion of farmers reported to receive at least MSP was very high as compared to states such as Assam (around 1.6 percent), Bihar (around 3.5 percent), Jharkhand (around 4 percent), Odisha (less than 11 percent), UP (around 12.2 percent) and West Bengal (around 8.2 percent). This is indeed an alarming trend. MSP is fixed based on cost of cultivation plus some margin over it. So, if overwhelming proportion of

farmers are unable to get MSP, it clearly reflects the prevalence of distress in the farming and put a question mark in the viability of paddy cultivation. In fact, more than 78 percent¹² of the farmers in total reported to receive less than the MSP during 2018-19.

Further, for states with higher average prices largely reflects higher price variation within the state. However, this relationship is not uniformly valid for all states. States like Karnataka, Madhya Pradesh, Uttar Pradesh, Gujarat, and Tamil Nadu are showing higher standard deviation (Figure 5) despite having low average and median price. However, states with relatively lowest average prices such as Bihar, Jharkhand, West Bengal, Assam, and Odisha are witnessing lower variation in prices with standard deviation less than 2. This clearly indicates that lower standard deviation or price variation is not something to celebrate for these states as it shows that large proportion of farmers are getting lower prices of their produce.

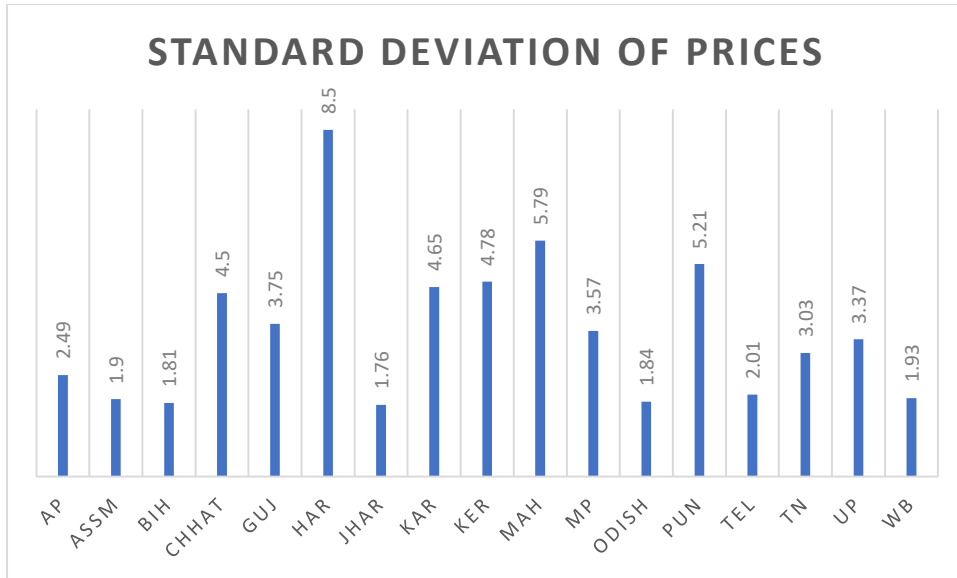
Figure 4: The pattern of Average price and Price deviation across states

¹² Authors calculations from unit level data of NSS 77th round.



Source: Same as Table 1

Figure 5: Price variation within states measured by standard Deviation.



Source: Same as Table 1

In nutshell, three broad patterns emerge from cross state price trends firstly, the variation of prices is substantial across states and there are clusters of states based on average price; secondly, largely, average regulated prices have been higher as compared to local market price for most of the states. And thirdly, barring a few states, median and mean prices are not very distinct which explains convergence of prices towards central values across states. Thus, average price can largely be dependent on state specific factors. To explore the factors affecting such price differential across states, following principal component analysis is done to reduce dimensionality of the possible variables affecting the same.

Section III: Principal Component analysis (PCM) of factors affecting prices across states

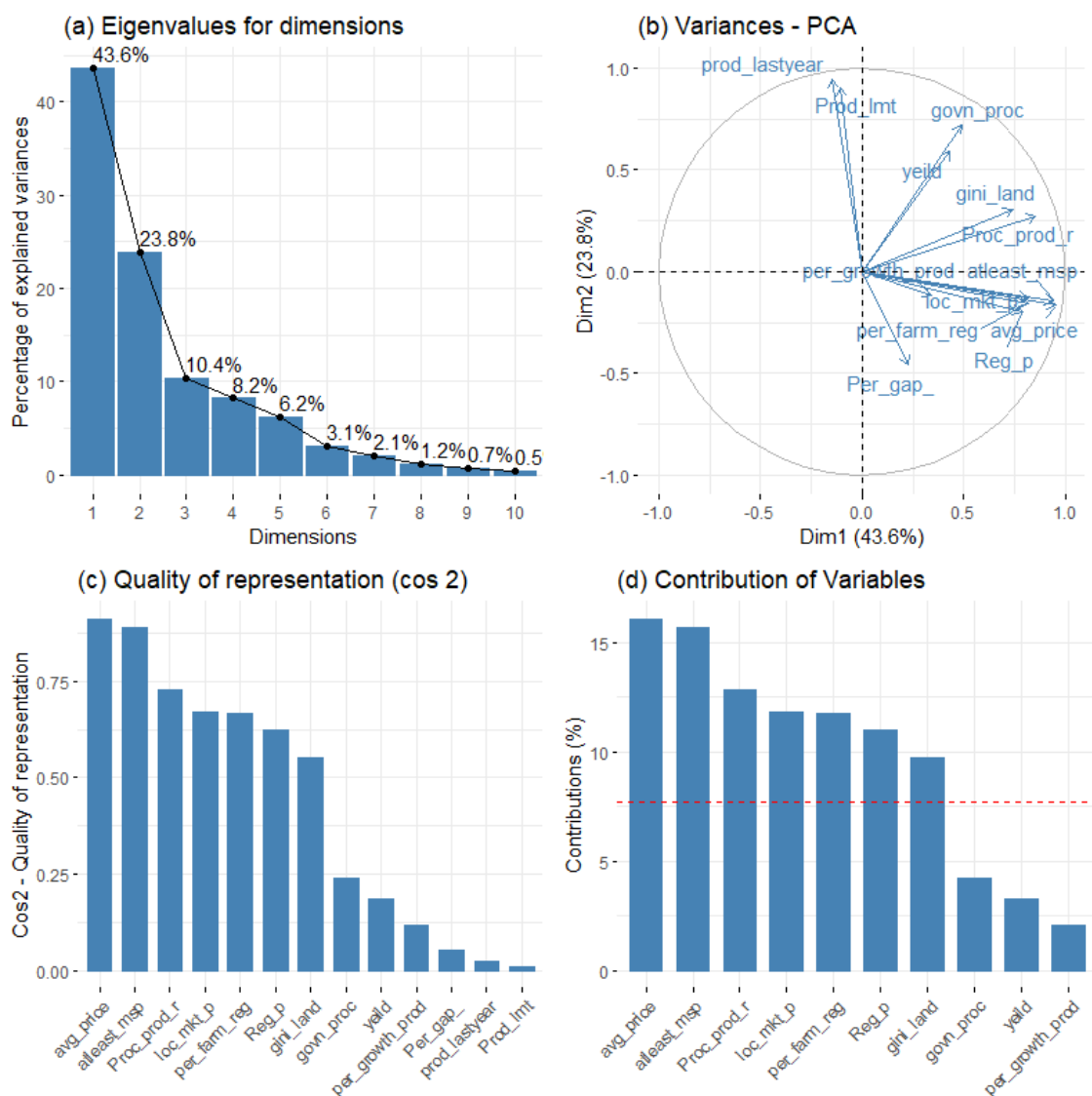
Table 6: Contribution of factors in different dimensions in PCM

	Dim.1	Dim.2	Dim.3	Dim.4	Dim.5
Percentage of farmers receiving at least MSP	15.7	0.65	0.1	0.48	1.53
Average Yield	3.31	11.17	8.1	16.45	4.47
Gini coefficient of land under paddy cultivation	9.71	3.05	10.87	1.11	13.23
Production in 2018-19 (in LMT)	0.2	26.32	6.33	0.03	9.16
Production in 2017-18 (in LMT)	0.4	28.86	1.2	0.01	4.23
Production growth 2017-19	2.05	0.43	47.17	3.73	9.71
Government Procurement (in LMT)	4.23	16.82	1.54	0.31	12.4
Reported sell of quantity in the regulated market (as a % of total government procurement)	0.91	6.83	2.84	55.07	0.01

Percentage of farmers selling in the regulated markets	11.78	0.77	8.93	2.15	9.75
Average Price	16.07	0.91	0.78	0.17	1.91
Local Market Price	11.84	0.56	10.36	0.42	10.91
Average price in the regulated markets	10.98	1.27	1.22	17	8.88
Government Procurement as a percentage of total production	12.82	2.36	0.57	3.08	13.82

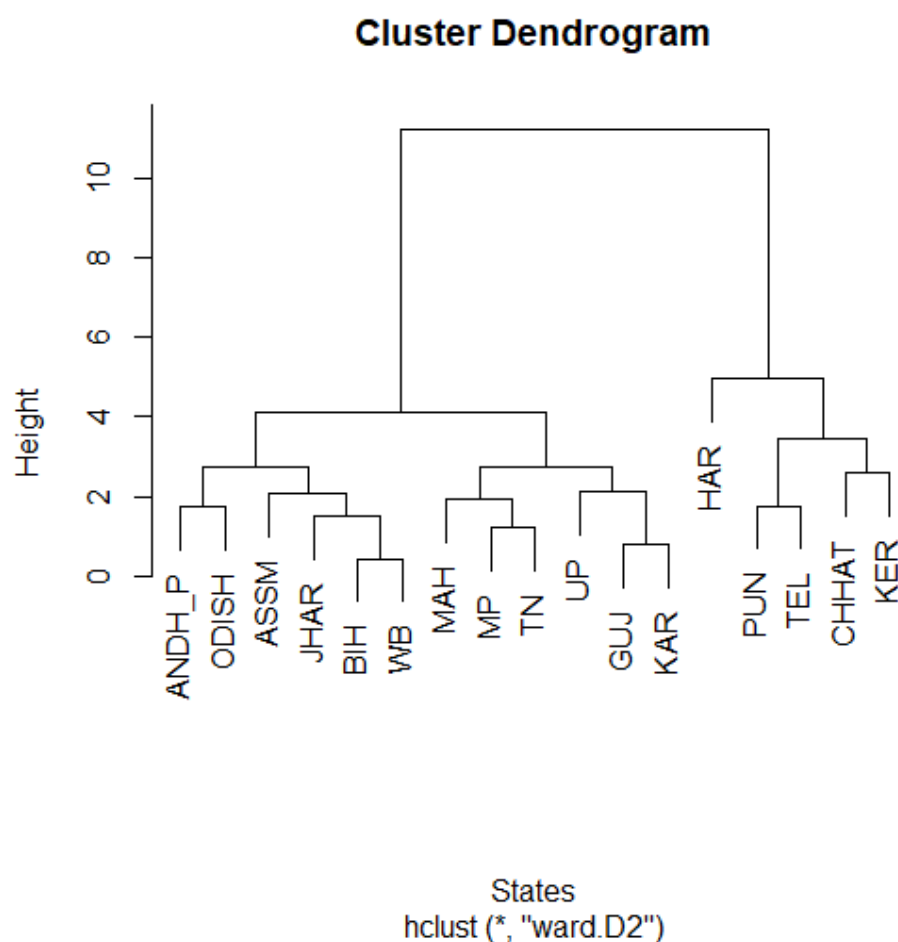
Source: Same as Table 1

Figure 6: Principal Component Analysis of Price related variables



Source: Same as Table 1

Figure 7: Dendrogram showing Cluster of states on the basis of Reduced dimension of PCM



Source: same as Table 1

Some of the common factors affecting prices are considered in this PCM models. Some of the factors which are expected to affect price such as production in the current year, in the previous year and change in the production are taken in the PCM model for dimension test. Further, yield is a good proxy of better agricultural conditions, including the level of irrigation, soil suitability, better input use etc. and regions with better yield are generally better agriculturally developed regions therefore agricultural markets are expected to be more developed with lesser price distortions. Thus, yield of various states is also taken as one of the possible factors affecting prices. Further, from the demand side, government procurement and related factors are included in the PCM model. Some of these factors are- government procurement in quantities, and in terms of percentage of total production of the respective states. As we have seen in the previous section that price offered in the regulated market is often higher than the market price, therefore percentage of farmers selling in the regulated markets and percentage of total quality sold by farmers out of total procurement are expected to be affecting average

prices and therefore could be a few additional factors responsible of state level variation in prices therefore included for checking of dimensions in the model. Further, it is also expected that not all categories of farmers have same bargaining power to get same prices, largely bargaining power in the market is expected to have some relation with land ownership. Thus, Gini coefficient of operational land under the cultivation is also considered as one of the possible factors affecting average price.

Principal component analysis results shows that first three dimensions contribute nearly 78 percent of total variation in the data and out of which the price related variation (dimension one) is contributing to more than 43 percent of total variation. The second dimension is primarily related to output and procurement related variables and for this paper, it is not relevant. Third dimension also pointing towards the relationship between change in output, yield and percentage of farmers selling in the regulated market along with local market prices (Table 6 & Figure 6). However, most of these factors are already part of the first dimension therefore, for the purpose of analysing price variation across states, dimension one is sufficient. Once dimension one is selected it becomes clear that some factors such as government procurement in absolute quantity, yield, production both current and previous year, change in production, percentage of quantity sold by farmers out of total government procurement are reflecting insignificant contribution in the dimension showing price variation. Thus, after dimension reduction the important factors which are contributing to the price dimension are identified.

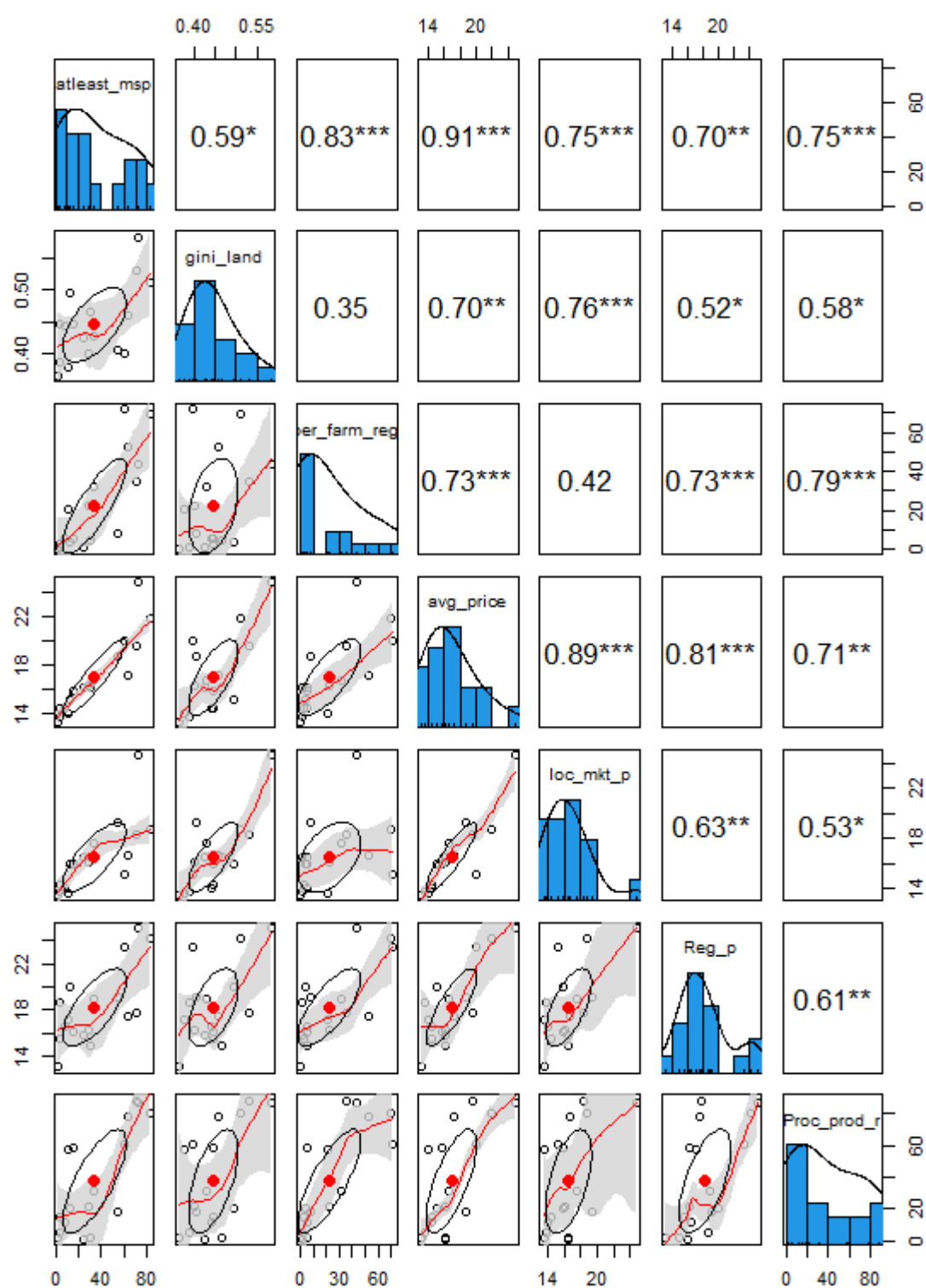
In terms of reduced factors there seems to be an existence of clusters of states. Figure 7 shows dendrogram reflecting cluster of states in terms of various factors such as government procurement as a proportion of total production, percentage of farmers selling in the regulated markets, Gini coefficients of lands, percentage of farmers receiving at least MSP along with price variables such as average price received by farmers, average price received in the regulated markets and average price received in the local markets. All these factors are very much high in states like Punjab, Haryana, Chhattisgarh, Telangana and Kerala. In other words, these states reflect strong presence of states in terms of procurement of paddy and a large proportion of farmers are selling in the regulated markets and all of them also witness relatively higher average prices received by farmers both in regulated markets and local markets. Further proportion of farmers receiving at least MSP has been very high for these states. On the contrary, Other two clusters (Figure 7) of states with relatively lower presence of states, all price related variables are comparatively lower than the first cluster of states. Presence of clear clusters in terms of government procurement and price of paddy received by farmers across

states clearly indicates prevalence of strong relationship between government procurement and price variation across states. For further exploration it is needed to understand how different factors are correlated to each other and how various indicators related to price across states are influenced by these factors. For this next section is dealing with pair wise correlation between selected factors to understand the relational aspects of the price variation across states.

Section IV: Understanding relational aspects of price variations across state

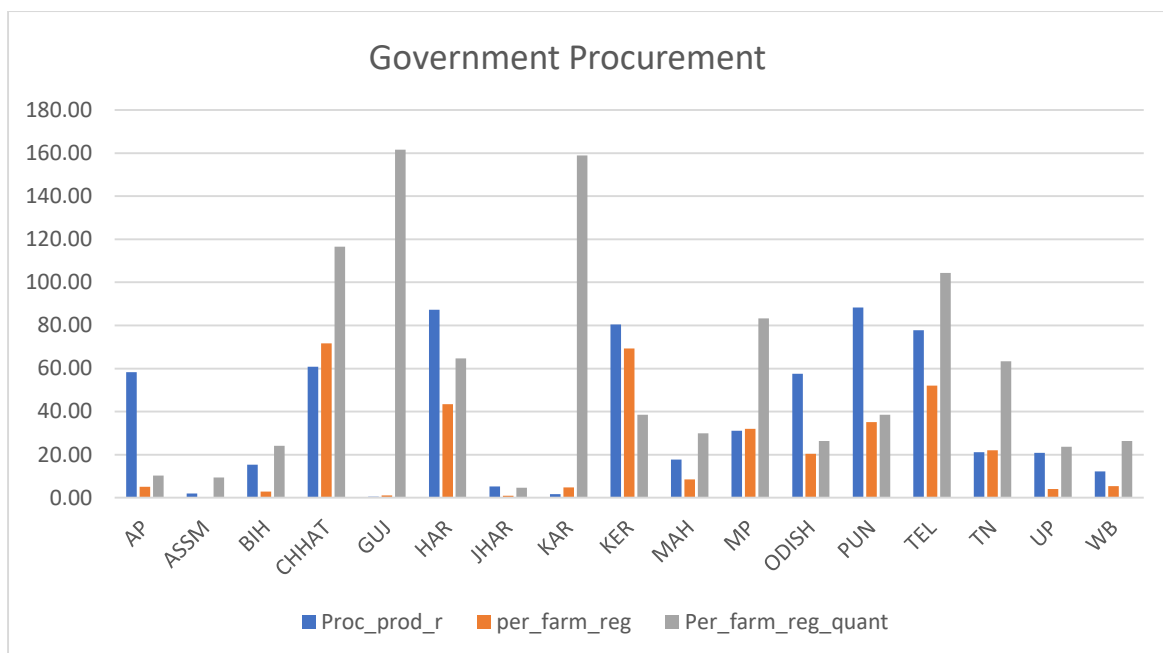
Corelation matrix (Figure 8) shows some very interesting relationship between different pairs of factors. It is clear from the figure that average price received by farmers is highly correlated with local market price and average price in the regulated market. This result is trivial as both local market price and average regulated price are the component of total average price and therefore needless to discuss here.

Figure 8: Correlation Matrix for various Price related variable



Source: Same as Table 1

Figure 9: Various indicators related to government procurement



Source: Table 2

As far as major determinants of price variation across states are concerned, government procurement remains extremely important. The average price is highly correlated with government procurement as a percentage of total production (Figure 9). So, states with higher procurement output ratio reflects higher average price. Further, percentage of farmers selling in the regulated market also affects price variation positively. States with higher proportion of farmers selling in the regulated market, are showing relatively higher prices. The correlation coefficient between average price and percentage of farmers selling in the regulated markets is higher as well as significant. In fact, both government procurement as proportion of total production and percentage of farmers selling in the regulated markets are highly correlated with percentage of farmers receiving at least MSP.

More interesting observations are there with the local market prices and it is found to be highly correlated with government procurement as a proportion of output. It means that local market prices which are market driven prices are bearing a strong and positive relation with proportion of government procurement to output of the state. It basically indicates two very important aspects of relationship between market price and government procurement. First, the state with higher proportional procurement indicates better implementation of MSP prices and therefore the possibility of convergence of market prices towards regulated prices is higher. Since relative procurement across states do not vary substantially over the years the impact of such procurement can be seen in the longer term. Thus, states with higher relative procurement leads to lower the gap between MSP and market price (or local market price). This seems further clear with the fact that there has been strong positive relationship between average price

in the regulated market and local market price. So, if states are having higher state presence in terms of procurement the local market price tends to converge towards regulated price. Since, the regulated prices have been higher than the local market prices for most of the states, higher average prices are observed in the states with higher procurement and higher average price prevailing in the regulated market. Secondly, even though the correlation between local market price is not significant¹³ with percentage of farmers selling in the regulated market, the direction of relation is somewhat telling the same story. Thus, higher procurement at relatively higher price tends to raise the average local market price in the upward direction may be through additional demand creation¹⁴. In other words, the tendency of convergence of local market price to the regulated price observed for states where government procurement as a percentage of total production and percentage of farmers selling in the regulated market is relatively higher. Here Bihar is a special case where APMC was abolished in 2006. Though there has been restoration of Primary Agricultural Credit Societies (PACS) in Bihar it could not improve the status of procurement in the regulated markets in any substantive manner (Kumar Anjani et al 2022). Some limitations of PACS in this regard have been, its omission error, local politics, and state's inadequate funding to carry out large procurement (Kumar 2021). Due to excessive dependence of farmers on local markets for procurement, the average price received by farmers in the state remains much lower than the MSP and the proportion of farmers getting at least MSP has been one of the lowest in the country. So, policy change with the abolition of APMC Act hardly had any positive impact on the status of farmers in terms of access to better prices of their produce. In fact, it is interesting to observe that for some nearby states like UP, Jharkhand and MP where direct government procurement has not been substantial, the APMC markets have offered highest average prices to farmers than any other agencies (Table 7). This could have been true for Bihar also. In other ways, it is likely that with the abolition of APMC markets, the farmers in Bihar have lost one of the most important procurement agencies to offer higher prices and it might have put upward pressure on local market price as well.

Table 7: The average rate of paddy received by farmers from various procurement agencies.

State	APMC	Coop	Govt. agency	FPO	Local Market	Input Dealer	Private Processor	Contract farming	other	NA
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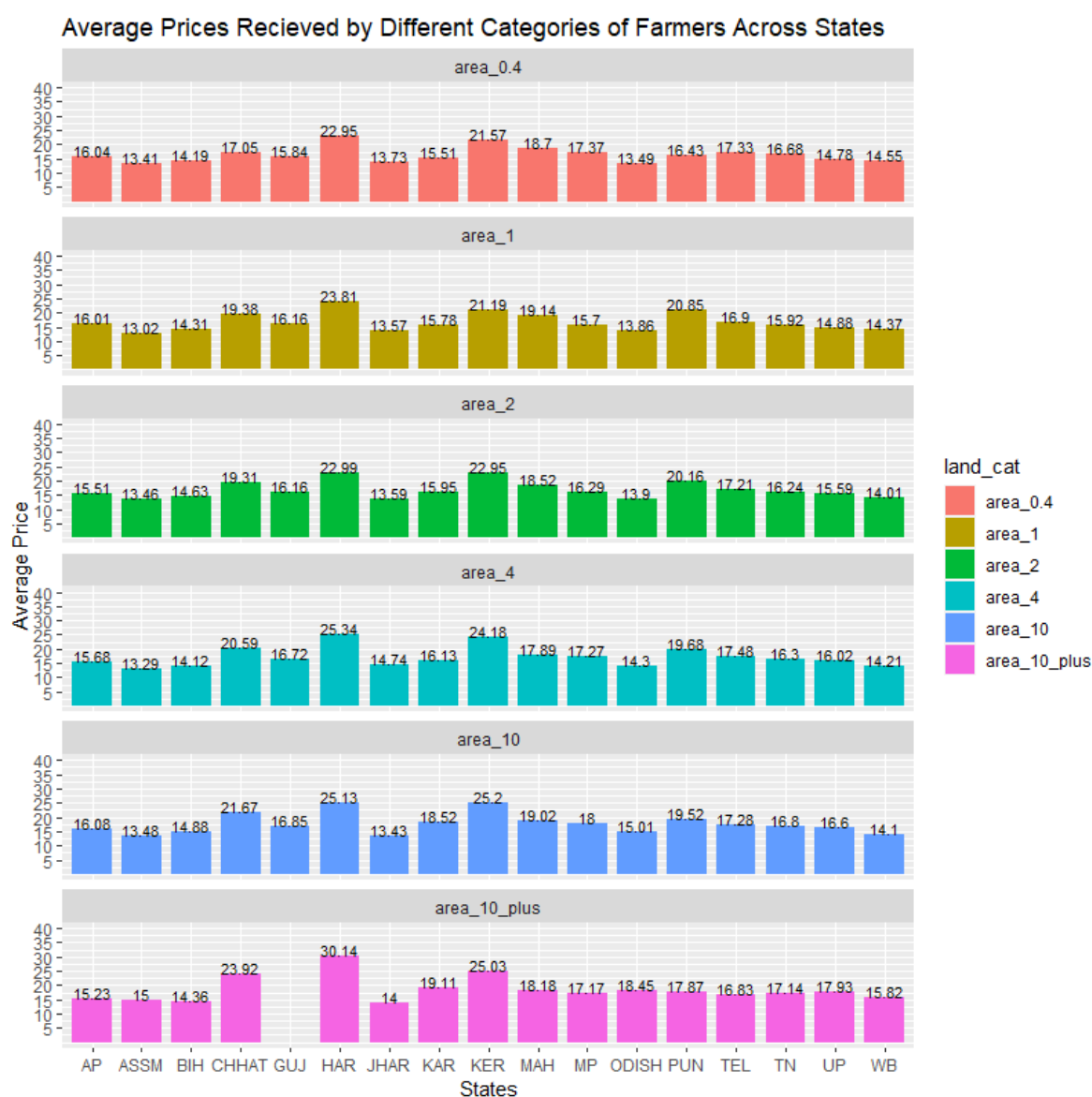
¹³ Though significant at 10 percent level (p values 0.094)

¹⁴ Similar analysis dealing with the government procurement on average *mandi* prices are done in (Chatterjee & Kapur 2016).

AP	21.50	15.54	15.08	14.82	15.90	16.09	15.30	#N/A	15.19	15.51
ASSM	#N/A	#N/A	#N/A	13.07	13.49	12.73	12.55	12.69	13.96	12.89
BIH	14.78	15.21	16.35	17.00	14.31	16.25	14.77	#N/A	14.48	14.32
CHHAT	21.83	23.56	23.11	#N/A	15.15	18.00	17.06	60.15	16.97	17.75
GUJ	15.76	16.66	#N/A	#N/A	16.47	15.06	16.88	#N/A	17.59	15.67
HAR	24.28	#N/A	28.70	#N/A	24.70	30.80	20.82	28.97	16.57	30.53
JHAR	19.00	17.00	19.00	#N/A	13.74	15.37	13.21	#N/A	13.07	13.65
KAR	15.03	14.88	#N/A	#N/A	16.45	14.03	13.55	#N/A	13.00	15.56
KER	#N/A	20.49	24.35	#N/A	18.78	#N/A	20.24	25.60	21.67	19.13
MAH	18.26	19.79	18.51	36.31	19.25	15.42	18.85	#N/A	19.58	18.09
MP	22.79	17.40	17.50	#N/A	17.58	19.23	16.24	#N/A	14.39	15.54
ODISH	16.84	16.92	17.35	18.00	13.53	13.78	13.63	18.43	14.51	13.73
PUN	17.70	#N/A	17.63	#N/A	18.36	17.52	#N/A	31.37	24.32	17.16
TEL	17.78	17.83	17.46	17.07	16.60	16.38	17.33	38.06	16.13	17.43
TN	16.34	14.51	16.84	#N/A	16.12	12.58	15.03	#N/A	23.71	17.69
UP	20.31	17.62	20.03	#N/A	15.90	16.61	16.06	15.71	20.69	14.51
WB	16.05	17.06	16.56	16.50	13.99	13.74	15.21	#N/A	15.28	14.59

Source: Same as Table 1

Figure 9: Size of the holdings and average price received by different categories of famrrers



Source: Same as Table 1

Note: area_1 - ≤ 0.4 acres of land, area_2 - more than 0.4 and less than or equal to 1 acre of land, area_4 - more than 2 acres and equal to or less than 4 acres of land, area_10 - more than 4 acres and less than or equal to 10 acres, are_10_plus- more than 10 acres of land.

Further, average price is showing positive relation to Gini coefficient of operational land. In fact, all price variables like average price, average price in the regulated market, average local market price and percentage of farmers receiving at least MSP are highly correlated with Gini coefficient of land. It indicates that larger farmers are having better bargaining powers in terms of receiving higher prices not only in the local market but surprisingly also in the regulated markets and this in turn leads to higher percentage of farmers receiving MSP with more

concentration of land. This is clear from the Figure 9 that for the entire country as whole, the average price received by farmers are regressive in nature. In most of the states, larger farmers are receiving higher average prices in general. Two states namely, Maharashtra and Punjab are exceptions to this trend. Possible explanation for such trends breaks in both the states might be the presence of strong farmers lobby, proximity to big cities, and cultivation of high values paddy (like *Basmati* particularly in case of Punjab under contract farming) etc. However, to explore the reasons and to test some of this hypothesis is beyond the scope of this article. Nonetheless, positive relationship between average price received by farmers and size of the holdings has been the dominant trend for most of the states. So, the states with the presence of larger farmers are on an average reflecting higher average price as compared to other states.

Summary and Conclusion:

Thus, the average price received by farmers has been different across states and the major correlates of such difference in prices has been the share of government procurement as a proportion of output of the state, along with the inclusiveness of government procurement in terms of percentage of farmers selling in the regulated markets. The average price in the regulated markets has been higher as compared to local market prices except for some states and there is evidence of conversion of local market price towards average regulated market prices for states in which government procurement has been higher as a percentage of total production and procurement is largely happening directly from the farmers. Thus, variation in prices across states both in the regulated and non-regulated market is highly correlated with the degree of government intervention in the procurement. So, with higher government procurement, farmers on an average receive higher price primarily on two accounts, first average price in the regulated market is higher than the local market therefore higher access to regulated markets gives farmers direct access to higher prices. Secondly, there is indirect effect as well which is based on the fact that higher procurement puts an upward pressure on local market price as well. So even if farmers are unable to sell their produce in the regulated markets, they get relatively higher prices in local markets in states having higher procurement production ratio. Thus, one may infer that if government procurement through MSP is reduced or done away with to rely more on competitive markets, there is a strong possibility that the market price for crops like paddy would collapse and the situation would deteriorate further¹⁵.

¹⁵ As more than 78 percent of the farmers in the country did not receive at MSP and any downward movement of price would have devastating impact on viability of farms.

The role of landownership has also been important in this regard and the evidence shows that not only in the non-regulated markets but also in the regulated markets, larger farmers are better placed in terms of bargain for higher prices. In regulated markets it is indeed a matter of concern and must be addressed through proper channels.

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