P-ISSN: 2618-0723
E-ISSN: 2618-0731

NAAS Rating: 5.04
www.extensionjournal.com

International Journal of Agriculture Extension and Social Development

Volume 8; Issue 2; February 2025; Page No. 302-307

Received: 13-11-2024
Accepted: 17-12-2024

Indexed Journal
Peer Reviewed Journal

Seasonal fluctuations and price dynamics in onion markets of Eastern Uttar Pradesh

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DOI: https://www.doi.org/10.33545/26180723.2025.v8.i2e.1650

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Abstract

The present study investigates the seasonal fluctuations in arrivals and prices of onions across four major markets in Eastern Uttar Pradesh—Ayodhya, Gorakhpur, Azamgarh, and Varanasi—using secondary data spanning from 2005-06 to 2019-20. The data were obtained from the Directorate of Agriculture Marketing, U.P., Rajya Krishi Utpadan Mandi Parishad, and other relevant sources. To analyze trends and patterns, a 12-month moving average technique was employed. The findings indicate that onion arrivals exhibit significant seasonality, peaking in the months of March to June, resulting in a glut in the markets and corresponding price depressions. Conversely, from July to January, a steady decline in arrivals was observed, leading to increased price indices due to reduced supply and storage costs. The study also highlights the inverse relationship between arrivals and prices, as confirmed by graphical representations. Moreover, irregular fluctuations in onion arrivals were identified, attributed to perishability, climatic variations, and supply chain disruptions. These findings emphasize the need for improved market intelligence and storage facilities to stabilize onion prices and ensure farmer profitability. The study provides policy recommendations for mitigating price volatility through better storage infrastructure and market forecasting mechanisms.

Keywords: Arrival, price, onion

Introduction

Onion is one of the most essential vegetables in Indian households and plays a crucial role in both domestic consumption and commercial production. The volatility in onion prices is a major concern for farmers, traders, and consumers, as fluctuations in supply significantly impact market stability and profitability (Ghosh, 2020) [2]. The onion market is characterized by pronounced seasonality due to the perishability of the crop, dependence on climatic conditions, and inefficiencies in post-harvest management (Kumar *et al*., 2019) [4]. Given the substantial contribution of Uttar Pradesh to India's onion production, understanding the factors affecting seasonal arrivals and price variations is imperative (Singh & Pandey, 2021) [9].

The supply chain of onions in India faces multiple challenges, including inadequate storage infrastructure, lack of price forecasting mechanisms, and inefficient distribution systems (Patil & Deshmukh, 2018) [6]. Due to these constraints, the seasonal gluts in the market lead to distress sales by farmers, while off-season scarcity results in price surges, affecting consumer affordability (Sharma & Gupta, 2022) [8]. Previous studies have indicated that fluctuations in onion arrivals are primarily driven by seasonal production patterns and are inversely related to price trends (Mehta *et al*., 2017) [5]. However, limited research has focused on the Eastern Uttar Pradesh region, where onion cultivation has seen substantial growth in recent years (Chaudhary & Verma, 2020) [1].

A critical examination of price and arrival trends using advanced statistical techniques can provide insights into market behavior and help formulate policy measures for stabilizing onion prices (Jain *et al*., 2016) [3]. The present study employs a 12-month moving average method to analyze seasonal variations in onion arrivals and prices across four major markets in Eastern Uttar Pradesh—Ayodhya, Gorakhpur, Azamgarh, and Varanasi. The study aims to identify seasonal trends, assess their economic implications, and propose strategies for mitigating price volatility through improved market intelligence and storage solutions (Reddy & Mohan, 2021) [7]. The findings of this study will contribute to the broader discourse on agricultural market stabilization and serve as a foundation for future policy recommendations (Tripathi & Yadav, 2019) [10].

Materials and Methods

The study is based on monthly data on arrivals and price of the aforementioned crops pertaining to the time period 2005-06 to 2019-2020 were collected from the secondary sources from the Directorate of Agriculture Marketing, U.P., Rajya Krishi Utpadan Mandi Parishad and related market official records. For the collection of primary information relating to constraints, pre-structured schedules were employed.

Moving average is a method used for the measurement of trend by smoothing out the fluctuation in the data. Moving average of extent 'n' is a series of successive average (Arithmetic mean) of n terms at a time, starting with the 1st,

2nd, 3rd etc. Thus the first average is the mean of 'n' terms, the second is the mean of the n terms from 2nd to $(n + 1)^{th}$ term, the third is the mean of n terms from 3rd to $(n + 2)^{th}$ term, and so on.

Since in the case of the 12-month moving average (n = 12), n is even, the moving average is placed between the two middle value of the time interval, i.e., between t = 6 and t = 7. Thus, to synchronize the moving average arid the original data, a moving average of the extent 2 of these moving averages is taken, putting the first of these values against $t = k + 1$, *i.e.*, t = 7.

Numerically, Let the total number of months be n and the wholesale price index be WPI_i, for month i. Hence the formula for 12 month moving average are given below:

$$MA_j^{12} = (\frac{1}{12}) \sum_{j=i-5}^{i+6} WPI_j$$

Where, j=6,7,……, (n-6) as MA_j^{12} =0 for j=1,2,..5 and i=(n-5),.., n.

And 2 month moving average

$$MA_j^{12} = (\frac{1}{12}) \sum_{j=i-1}^{i+1} MA_j^{12}$$

Where, j=7,8,.., (n-6) as MA_j^2 =0 for j=1,2,..5 and i=(n-5),.., n

Results and Discussion

The seasonal behavior of arrivals and prices of onion was studied for three selected markets included in the study. The fluctuations in the arrivals and prices of onion are mainly the result of such factors which uniformly and regularly fluctuate in magnitude. These variations are periodic and regular. From the study, it was found that in Ayodhya market, onion started arriving towards the end of March. Table- 1 indicates that the concentration of the arrivals was the highest in the month of April and May. Arrivals in March, April, May and June were 8.48 per cent, 9.01 per cent, 10.59 per cent and 10.40 per cent, respectively which accounted for 38.49 per cent of the arrivals during the year, the remaining year accounted for 61.51 per cent. It indicated that onion marketing was quite seasonal. In the months of March to June, more than half of the onion crop was marketed. There was glut of produce during these months in the market which resulted in low prices in these months.

From the study of Gorakhpur market, it was found that onion started arriving at the end of February. Table- 2 indicates that the concentration of the arrivals was the highest in the months of April and May. Arrivals in February, March and April, were 7.32 per cent, 9.90 per cent, and 10.36 per cent respectively which shared for 27.59 percent of the arrivals during the year, the remaining year accounted for 72.42 per cent. It indicated that in the months of February, March, and April little less than half of the onion crop was marketed in the Gorakhpur market. This causes gluts of produce during these periods in the market which resulted in low prices in these months.

Table 1: Index of seasonal variation in arrivals of Onion in market of eastern Uttar Pradesh (Ayodhya) 2005-06 to 2019-20

Year	January	February	March	April	May	June	July	August	September	October	November	December
2005							68.56668	75.59606	159.6712	95.90666	56.13869	160.9262
2006	46.48821469	58.48319	70.29388	84.55736	134.9993	87.45596	131.8533	111.6166	88.2985	88.19485	112.5041	132.3299
2007	103.5987655	82.76546	93.44196	93.87007	99.87118	95.22663	97.38027	91.64807	132.4755	73.22044	86.34735	90.29862
2008	116.227867	109.2876	95.90067	141.941	118.104	97.46635	95.6226	48.90454	105.6139	110.7603	94.12813	91.27767
2009	84.12320455	87.66268	127.3679	74.14539	132.434	108.3511	97.01996	100.3673	98.07846	62.86595	108.4318	132.6302
2010	123.984944	74.35776	109.6209	94.64673	126.5083	83.69278	99.25072	102.9787	90.48215	98.37389	98.82391	102.1813
2011	64.77076776	90.24871	123.4426	96.97104	120.6152	98.03519	97.66383	95.39815	91.05975	99.31167	98.23041	99.33864
2012	111.6813244	98.85612	88.79308	92.2303	88.72139	107.1122	79.99047	69.69376	69.8509	61.04018	80.12868	185.4005
2013	161.974962	112.1262	140.9	84.17398	119.2787	86.99293	60.30289	51.30318	56.99984	83.70591	94.7798	171.8925
2014	117.9542982	99.73837	101.7706	106.5516	92.63119	93.02617	98.92886	115.378	101.4104	85.36825	94.72757	92.84311
2015	98.65386426	145.0963	114.844	119.1572	147.9354	127.1044	63.96395	33.37113	29.1392	53.84291	84.96119	188.3492
2016	56.11381401	68.8962	85.40091	89.24002	124.8159	162.4165	90.4522	95.82076	106.2021	81.89398	105.0676	104.0955
2017	79.02498675	45.05989	123.3716	162.0265	111.126	164.7827	84.21831	88.24348	61.95946	126.8977	76.06754	103.5124
2018	64.37606531	54.67595	103.8582	95.48315	131.6333	188.7418	61.45703	81.88629	60.90682	64.58701	116.7138	100.3722
2019	69.83611548	116.6528	83.15774	121.8897	149.13	182.654	48.62044	86.90824	75.14872	90.59804	84.35842	138.271
2020	56.59577378	35.29773	61.51348	162.015	204.556	186.5652						
Average	90.36033117	85.28033	101.5785	107.9266	126.824	124.6416	85.01943	83.27428	88.48646	85.10451	92.7606	126.2479
Adj Value	90.54862858	85.45805	101.7902	108.1515	127.0883	124.9013	85.1966	83.44781	88.67085	85.28186	92.9539	126.511
Percentage	7.545719048	7.121504	8.482515	9.012626	10.59069	10.40844	7.099717	6.953984	7.389238	7.106822	7.746158	10.54258

Table 2: Index of seasonal variation in arrivals of Onion in market of eastern Uttar Pradesh (Gorakhpur) 2005-06 to 2019-20

Year	January	February	March	April	May	June	July	August	September	October	November	December
2005							97.6096	8.371666	98.4634	58.25334	56.26562	63.33315
2006	58.96511	41.28626	87.78998	313.5475	127.7901	122.9325	88.90644	15.6422	108.956	78.61104	103.0866	106.6601
2007	132.6388	151.6646	150.8191	9.592947	82.67185	110.7023	63.31498	83.72845	113.6755	76.51361	149.5561	123.2202
2008	86.35744	74.49055	78.86581	118.3873	157.687	93.48966	82.04654	100.0933	103.1904	113.9078	81.11784	77.86594
2009	105.9579	117.4324	97.79885	93.62168	126.9772	105.0886	81.3702	106.4164	83.3087	108.5662	88.97853	106.0336
2010	14.76235	83.22239	125.3249	114.7193	108.3779	122.2737	126.5254	121.6654	79.48661	92.27382	65.39849	53.50086
2011	113.5463	99.88496	170.7756	157.698	100.8786	88.99295	80.40091	53.17902	87.52938	72.12409	109.21	148.0524
2012	89.1804	101.8616	121.1428	108.7282	111.7136	105.7995	65.91633	94.58974	106.5904	91.01789	74.01416	80.34563
2013	153.6558	95.02696	99.4124	121.8908	170.7107	123.7019	84.9607	62.99879	31.797	28.87983	47.5801	125.8133
2014	120.549	143.8725	147.7164	114.0797	135.1322	95.10364	57.21882	71.22027	79.73322	92.54883	85.59838	77.34728
2015	166.4832	94.42084	112.3747	126.5303	137.0993	103.9283	110.9215	62.90781	48.32505	28.65246	135.473	130.0133
2016	114.306	81.87725	159.0316	86.16286	72.74737	122.0569	115.3184	104.8907	117.6819	81.62674	85.42098	76.43553
2017	26.95776	52.68058	82.78071	152.0274	122.6163	202.5143	233.8117	91.36781	85.6219	61.13557	51.37479	47.59257
2018	65.18484	38.50429	85.82523	116.6589	122.7309	90.99112	67.78231	90.0508	157.8202	136.9664	141.8605	169.4228
2019	9.892238	50.74734	104.7369	69.57763	135.9484	106.6951	90.99296	88.60827	112.6212	96.55135	109.4254	56.58715
2020	78.08252	75.72448	137.355	141.2302	75.77779	101.6161						
Average	89.10132	86.84647	117.45	122.9635	119.2573	113.0591	96.47312	77.04871	94.32006	81.17527	92.2907	96.14824
Adj Value	90.14294	87.86172	118.823	124.401	120.6514	114.3808	97.60092	77.94942	95.42268	82.12422	93.3696	97.27224
Percentage	7.511912	7.32181	9.901918	10.36675	10.05428	9.531734	8.13341	6.495785	7.95189	6.843685	7.7808	8.10602

Table 3: Index of seasonal variation in arrivals of Onion in market of eastern Uttar Pradesh (Azamgarh) 2005-06 to 2019-20

Year	January	February	March	April	May	June	July	August	September	October	November	December
2005							140.0454	123.9928	88.96356	53.7889	62.49733	137.6703
2006	240.2439	154.8795	65.96206	84.07363	77.07516	100.7406	98.74501	88.66063	55.34182	58.98795	91.76341	308.728
2007	127.3944	58.72927	58.02769	111.5546	121.1137	173.9711	85.93839	108.3367	78.24829	48.41264	44.64421	42.10992
2008	41.3948	107.8387	189.1503	210.706	242.9497	108.4201	78.27887	83.82297	67.24007	92.51067	72.81133	91.91251
2009	145.3	99.19849	121.5427	102.3057	148.9278	97.68733	113.276	87.60771	99.75186	115.4316	92.40983	89.04348
2010	120.0607	103.5897	116.3248	116.99	149.5071	104.6729	125.1365	96.28423	92.61686	109.1061	87.43531	104.4127
2011	75.68769	101.6738	136.8126	157.1884	108.8985	96.3437	120.9614	84.87944	114.507	92.39638	98.36729	150.8295
2012	115.0247	95.15222	112.6906	99.44157	103.7116	124.0819	99.8551	100.2821	61.04587	39.19468	36.79042	27.28505
2013	26.23938	99.20395	192.9054	173.0055	232.8042	198.6463	163.6533	51.37338	12.4705	12.92001	36.39857	126.5263
2014	172.3508	143.3872	126.0556	149.8314	131.955	108.0189	49.81954	96.89159	93.59435	145.2426	99.00033	155.5531
2015	16.09845	122.7429	135.2339	90.50102	144.1837	109.7451	155.6596	79.13822	61.22117	114.4098	100.08	114.2166
2016	141.6703	144.3658	93.96304	105.0578	76.26017	68.7147	92.10961	82.97771	113.1863	118.4784	122.9103	195.4242
2017	127.0858	125.1208	162.199	107.1692	4.497093	90.56639	120.2757	77.31668	121.3158	96.41941	78.05924	102.8317
2018	119.835	107.5677	133.0143	150.4977	149.1374	125.4548	84.00735	65.40707	81.20927	98.91646	83.05717	126.0078
2019	130.7317	126.2547	143.4858	151.9513	143.0311	120.9508	110.9717	73.20516	48.87816	59.27932	35.62249	17.34355
2020	138.8799	187.0637	160.8201	100.2053	210.1448	179.0024						
Average	115.8665	118.4512	129.8792	127.3653	136.2798	120.4678	109.2489	86.67842	79.30606	83.69966	76.12315	119.3263
Adj Value	106.7327	109.1136	119.6407	117.325	125.5368	110.9712	100.6367	79.84549	73.0543	77.10155	70.1223	109.9197
Percentage	8.894388	9.092802	9.970059	9.777081	10.4614	9.247602	8.386393	6.653791	6.087858	6.425129	5.843525	9.159976

Table 4: Index of seasonal variation in arrivals of Onion in market of Varanasi 2005-06 to 2019-20

Year	January	February	March	April	May	June	July	August	September	October	November	December
2005							53.61535	51.30094	57.04712	72.91369	74.59161	81.76075
2006	126.9119	124.8584	180.9287	116.8992	96.04883	85.47092	78.60904	83.69972	96.08426	97.45093	105.3969	91.34905
2007	148.8151	143.2701	110.3075	117.6308	152.1403	43.26917	21.63037	22.15039	26.73858	23.89011	27.72438	187.6874
2008	151.1282	173.9587	160.9341	112.6675	83.26396	99.177	57.94129	108.7415	95.63722	101.5839	79.91196	56.10721
2009	99.59495	107.2	176.2006	121.6146	117.8533	49.37387	51.99531	130.0678	123.1653	40.99938	85.35226	104.2899
2010	56.31792	105.3446	146.8119	123.4209	174.3116	107.4379	103.0754	108.5808	55.89039	54.4949	60.83358	66.29759
2011	76.49159	149.5388	200.9357	121.8647	109.2489	99.16588	71.81658	66.87736	74.45569	88.38921	94.01902	100.0396
2012	110.3687	124.8617	114.2631	108.0893	103.4379	90.36567	99.40595	99.94627	84.90514	96.40622	87.34045	86.02604
2013	88.33327	78.91554	129.9269	135.8606	187.3416	105.6682	129.7955	100.6781	59.21159	17.24013	22.97444	126.4396
2014	122.6235	85.30429	48.99541	45.09864	41.81543	33.48679	97.48317	144.8344	184.6807	27.29817	87.11557	107.9014
2015	119.5147	97.94398	104.8895	116.7599	118.5034	90.82137	98.99845	76.45833	120.1356	89.97006	146.1561	145.8972
2016	14.92189	203.9407	22.94695	24.69752	100.2809	152.3884	94.82569	69.69449	105.2978	81.01221	89.72055	99.68203
2017	184.5666	195.2543	124.6787	69.59841	69.3043	61.38995	57.12207	62.10954	107.3824	87.72316	92.95891	134.8818
2018	126.62	124.0382	131.3008	106.7727	70.56847	66.3509	84.90225	76.36892	103.1455	108.3421	112.2053	133.5453
2019	68.66193	48.51171	47.45973	131.8987	122.0854	131.3624	158.6276	157.9875	150.5273	99.92134	47.72047	33.58482
2020	32.87646	28.95512	26.41506	115.008	240.2478	188.5579						
Average	101.8498	119.4597	115.133	104.5254	119.0968	93.61909	83.9896	90.63308	96.28698	72.50904	80.93477	103.6993
Adj Index	103.4238	121.306	116.9123	106.1408	120.9374	95.06594	85.28764	92.03379	97.77507	73.62965	82.18559	105.302
Percentage	8.618653	10.10883	9.742693	8.84507	10.07812	7.922162	7.107303	7.669482	8.147922	6.135804	6.848799	8.775163

From the study of Azamgarh market it was found that onion started arriving at the end of February. Table- 3 indicates that the concentration of the arrivals was the highest in the months of January to May. Arrivals in these January, February. March, April, and May months were 8.89 per cent, 9.09 per cent, 9.97, 9.77 and 10.46 per cent respectively which accounted for 48.19 per cent of the arrivals during the year, the remaining year accounted for 51.80 per cent. It indicated that in these months, more than half of the onion crop was marketed, suffered in low prices in these months.

From the study of Varanasi market, it was found that onion started arriving at the end of February. Table- 4 indicates that the concentration of the arrivals was the highest in the months of April. Arrivals in these January, February. March, and April, months were 8.61 per cent, 10.10per cent, 9.74, 8.84 and 10.06 per cent respectively which accounted for 47.36 per cent of the arrivals during the year, the remaining year accounted for 52.64 per cent. It indicated that in these months, more than half of the onion crop was marketed, suffered in low prices in these months.

The seasonal nature of the production and supplies of onion depresses the seasonal price index in the kharif season because of the local production as well as the commercial production in other parts. It can be observed from the Table 5 to Table-8 that the seasonal price index and seasonal arrival index moved in opposite direction to each other in each market of Ayodhya, Gorakhpur Azamgarh and Varanasi. Corresponding to the month of March to June, seasonal arrival index was maximum whereas, seasonal price index was minimum for each market, respectively. Similarly, seasonal price index was lowest for overall situation of eastern U.P. market.

From July to January, although there was a more or less same supplies of onions in the Ayodhya Gorakhpur Azamgarh and Varanasi markets, yet the price index went on increasing in these months from 82.21 in July, 105.17 in August, 119.37 in September, 130.30 in October, 138.95 in November, 129.07 in December for Ayodhya Market. The price index for Gorakhpur market was 87.86 in February, 118.82 in march, 124.40 in April, 120.65 in May. The price index of Azamgarh market was 106.73 for January, 109.11 for February, 119.64 for march, 117.32 for April and 125.53 for may while for Varanasi it was 83.85 in July, 111.89 in August, 121.17 in September, 143.25 in October,139.57 in November, and 121.61 in December. This increase in the price index was observed even after the receipt of the local kharif season produce increase in price was due to carry over costs of produce and This off- season. Similarly, in overall situation of eastern Uttar Pradesh there was continuous decrease in the arrivals of the onion from July to January, as a result of which increasing seasonal price index was observed for these months.

Table 5: Index of seasonal variation in price of Onion in market of eastern Uttar Pradesh (Gorakhpur) 2005-06 to 2019-20

Year	January	February	March	April	May	June	July	August	September	October	November	December
2005							68.87794	79.29237	116.584	138.0336	182.9359	131.7907
2006	102.6899	145.3626	110.7641	46.25442	53.57929	63.50937	71.37227	88.52776	118.3566	122.5561	124.4881	114.6381
2007	89.33151	63.19036	57.9602	88.31095	78.04203	72.63368	101.9027	130.4602	134.736	143.4181	138.2036	69.82444
2008	122.9161	132.1651	124.0745	49.21975	50.08112	52.18801	57.74873	83.28461	102.8571	98.53932	109.5064	128.1521
2009	162.1872	142.2706	102.5888	82.18573	67.43564	58.02126	74.27937	69.39864	73.66839	116.9734	135.688	132.6383
2010	254.1499	110.3837	67.63248	63.05935	48.78288	45.54909	53.68683	73.03493	111.3507	156.4994	183.4559	245.9203
2011	67.08524	59.46606	56.72607	56.02466	58.96507	67.41627	95.53962	108.9398	130.8171	127.9931	103.9418	87.32791
2012	122.3226	162.1791	124.373	69.23733	68.32812	60.7996	66.45942	89.00541	86.2477	89.47119	115.2995	127.9232
2013	114.8673	88.43181	78.29926	67.45917	50.50703	47.31339	82.55591	143.3754	182.1577	189.4533	178.1649	85.2796
2014	69.99783	67.74972	75.63379	59.19977	70.7831	84.06659	118.6943	118.3906	108.6339	125.2981	107.0263	103.8118
2015	87.21474	76.27244	58.84572	76.28515	71.75642	72.00968	85.50293	145.7675	227.9773	159.9359	144.4746	95.53329
2016	45.08336	46.93927	57.94047	91.36889	90.98283	90.73993	89.11675	86.3804	73.33538	56.78025	49.11512	47.24976
2017	154.4423	115.9982	71.50591	432.4739	38.08675	34.44538	30.88803	83.56688	81.22331	123.5772	198.1824	213.6077
2018	47.6632	48.58495	47.55918	70.77973	71.24162	88.65058	120.3654	98.25508	82.49907	88.42504	74.76636	61.08159
2019	261.1768	155.4828	110.404	45.15261	50.36294	44.64128	51.25674	66.4075	116.0901	137.9086	154.7943	247.8498
2020	101.928	123.2779	83.84698	56.50144	36.26275	83.11034						
Average	120.2037	102.517	81.87697	90.23419	60.34651	64.33963	77.88313	97.60581	116.4356	124.9908	133.3362	126.1752
Adj Valu	121.6089	103.7154	82.83413	91.28905	61.05197	65.09178	78.7936	98.74685	117.7968	126.452	134.8949	127.6503

Table 6: Index of seasonal variation in price of Onion in market of eastern Uttar Pradesh (Ayodhya) 2005-06 to 2019-20

Year	January	February	March	April	May	June	July	August	September	October	November	December
2005							60.89617	75.51455	101.6424	180.559	215.265	167.9246
2006	90.47195013	80.09587	69.87863	65.03084	57.90216	71.09172	87.19008	71.73243	86.71147	70.97302	94.2097	82.21028
2007	136.8719038	163.5505	114.1117	80.00352	61.83528	62.2879	89.6791	112.4094	148.394	167.3196	147.0336	172.5195
2008	55.49670585	54.55518	59.18605	65.1214	60.23981	64.46805	76.44473	107.9527	102.8316	94.93519	115.5671	133.8719
2009	138.2740612	123.4566	119.9214	79.16401	68.3414	64.38018	85.75589	78.83833	81.21858	140.6613	149.3584	125.3885
2010	133.4621889	126.045	104.6963	61.41159	56.50714	50.90198	30.86344	73.83108	95.80365	120.3834	137.984	172.5554
2011	225.7747468	115.2365	64.48389	50.59371	51.7162	55.74645	77.47259	119.1029	147.334	148.1123	128.1007	95.4691
2012	83.67726161	77.82941	82.56881	86.59319	85.65225	77.81636	81.90715	84.1003	77.2895	79.71779	115.8305	125.4596
2013	109.5328786	139.4604	92.40071	63.03441	48.10986	49.83058	80.35398	142.4622	194.1528	203.0845	175.7553	79.31359
2014	56.62351969	55.27251	59.35568	61.73757	75.41659	87.97289	133.543	125.1487	114.1302	102.3809	104.7627	88.88659
2015	96.1560291	87.71058	81.63121	75.09753	68.06761	65.2823	86.6536	173.1162	206.6569	161.9686	112.9575	81.26787
2016	72.84854881	64.06254	68.3112	81.2973	81.76863	83.70248	99.29815	99.32432	86.52546	87.03141	99.98631	98.05362
2017	120.6208426	98.12155	94.93824	84.84717	61.521	52.26196	49.62741	105.1548	95.00547	126.5796	166.1635	173.4749

2018	168.3352172	118.0273	64.09598	53.10595	49.19041	67.35948	116.5657	115.8315	108.2573	117.8047	128.147	83.36005
2019	80.61882252	69.07147	69.26968	64.73043	64.05966	54.44756	62.23563	74.20915	123.2652	130.1692	168.3239	233.3348
2020	147.5534598	85.48045	74.61527	53.73134	34.10706	84.15684						
Average	114.4212091	97.19839	81.29765	68.36666	61.629	66.11378	81.23244	103.9152	117.9479	128.7787	137.2963	127.5394
Adj Valu	115.7975928	98.36759	82.27559	69.18905	62.37035	66.90907	82.20959	105.1652	119.3667	130.3278	138.9479	129.0735

Table 7: Index of seasonal variation in price of Onion in market of eastern Uttar Pradesh (Azamgarh) 2005-06 to 2019-20

Year	January	February	March	April	May	June	July	August	September	October	November	December
2005							77.7211	93.77474	116.0288	176.1557	204.3172	157.0681
2006	97.85472	95.76378	73.59956	89.58548	82.55226	78.35643	97.54217	83.82878	82.08547	98.08853	101.4936	87.11693
2007	134.4364	168.9043	137.0821	84.22387	68.18591	75.48732	91.77652	129.1245	160.5494	193.911	178.7096	102.0671
2008	75.14293	67.085	80.6411	76.6595	68.54643	72.4032	81.33549	96.58314	115.0285	108.0151	120.7766	143.063
2009	144.0597	141.0157	129.3817	93.59275	75.00891	71.3033	81.82115	82.68893	81.70962	142.6755	164.7093	148.4609
2010	155.5115	151.1584	103.1157	74.26848	57.59926	53.59031	57.34288	62.33103	87.46751	128.0824	159.7544	207.658
2011	248.2866	110.5543	69.71088	55.60137	55.20226	58.12972	88.22454	123.2279	160.9926	163.0319	142.5827	112.4589
2012	92.7405	86.26377	89.43682	96.36818	88.19678	77.59274	91.70891	95.66041	88.54517	88.63075	121.4177	125.8559
2013	119.6451	143.4942	91.89774	66.63367	50.85111	50.39129	87.77503	161.4469	208.3408	231.1691	135.9492	114.1392
2014	68.08549	59.20243	66.82019	75.55929	85.74724	97.19925	137.728	132.637	116.5455	113.4252	111.8182	107.853
2015	108.3944	100.2196	97.96934	78.94179	72.55847	74.21074	85.20055	154.8898	220.395	181.1628	149.5376	98.93333
2016	81.22311	76.09541	73.21938	82.74718	89.59144	86.72368	110.5743	112.8151	107.2561	95.21011	111.3728	117.6272
2017	109.1935	116.9054	116.0052	108.9114	81.70921	73.91973	55.58692	13.69528	111.2406	138.6061	174.3118	203.4059
2018	198.5113	159.8708	10.61284	79.98708	67.64239	74.17666	123.577	137.6801	122.8944	129.3102	141.9267	108.1275
2019	108.6397	80.01528	66.49853	64.47673	66.46754	58.46454	58.3003	68.82538	116.4056	139.8474	173.7243	252.7542
2020	164.5843	109.0198	90.33905	75.22461	42.15378	86.94159						
Average	127.0873	111.0379	86.42201	80.18542	70.1342	72.5927	88.41433	103.2806	126.3657	141.8214	146.1601	139.1059
Adj Valu	117.0689	102.2847	79.60929	73.86434	64.60546	66.87016	81.44455	95.13891	116.4042	130.6415	134.6382	128.1401

Table 8: Index of seasonal variation in price of Onion in market of eastern Uttar Pradesh (Varanasi) 2005-06 to 2019-20

Year	January	February	March	April	May	June	July	August	September	October	November	December
2005							76.38158	92.24558	121.3378	129.0896	149.2865	144.3338
2006	72.04803202	73.94066	77.58081	74.24098	72.46768	65.33152	81.77617	99.34434	87.92701	95.36106	89.61566	98.5565
2007	153.2195927	173.2134	121.026	70.54508	52.37975	60.67165	33.16609	121.8835	158.3569	315.7265	133.8742	64.67436
2008	59.7895165	51.87355	48.77791	57.28097	65.6818	65.59435	111.6146	104.4438	100.7464	89.69397	121.8585	122.9517
2009	144.6476123	133.816	109.88	77.67422	61.15394	69.85447	80.61012	75.9355	75.23511	136.9563	148.0638	133.5687
2010	140.770665	134.9206	94.95612	66.28452	45.69594	46.97033	60.17029	76.81733	107.8438	154.5879	171.2768	214.8754
2011	122.8339548	66.49283	55.20414	50.88619	58.54112	61.29199	93.66079	133.8223	154.5482	147.0678	121.2183	94.86943
2012	81.31595282	77.69051	81.52809	89.01389	75.71879	72.92587	90.1978	88.50863	79.63558	86.14654	106.0698	102.0759
2013	116.9332598	160.4687	78.11133	69.38181	46.84958	46.45998	77.59681	162.7552	170.3741	202.4158	209.124	55.19779
2014	54.81113659	53.58829	60.52648	61.60068	73.94747	91.49658	129.7897	127.7279	107.9186	108.2244	103.7891	92.30769
2015	93.44391596	93.75568	94.51259	84.00977	74.10542	67.07763	76.49489	146.0157	180.4677	157.9154	154.4983	84.91028
2016	73.48904	73.80094	67.27924	75.46018	84.46884	73.52276	86.13027	102.3833	85.6756	94.93809	101.1077	109.8611
2017	101.8215356	101.5308	101.5924	75.58371	56.43164	52.70526	65.10481	107.9336	90.97473	150.8418	173.7194	165.3913
2018	144.2429355	93.49337	58.0169	54.00397	53.82436	106.5552	113.3528	113.9241	109.0909	133.2012	110.4536	75.69721
2019	87.24335241	71.22581	63.05975	60.95618	58.43293	55.19779	64.01028	101.0101	161.8098	116.3166	170.0369	239.1814
2020	114.5072313	69.87435	69.03164	40.06359	28.09493	56.20609						
Average	104.0745156	95.31237	78.7389	67.13238	60.51961	66.1241	82.67046	110.3167	119.4628	141.2322	137.5995	119.8968
Adj Index	105.5629165	96.67546	79.86496	68.09246	61.38512	67.06976	83.85276	111.8944	121.1713	143.252	139.5674	121.6115

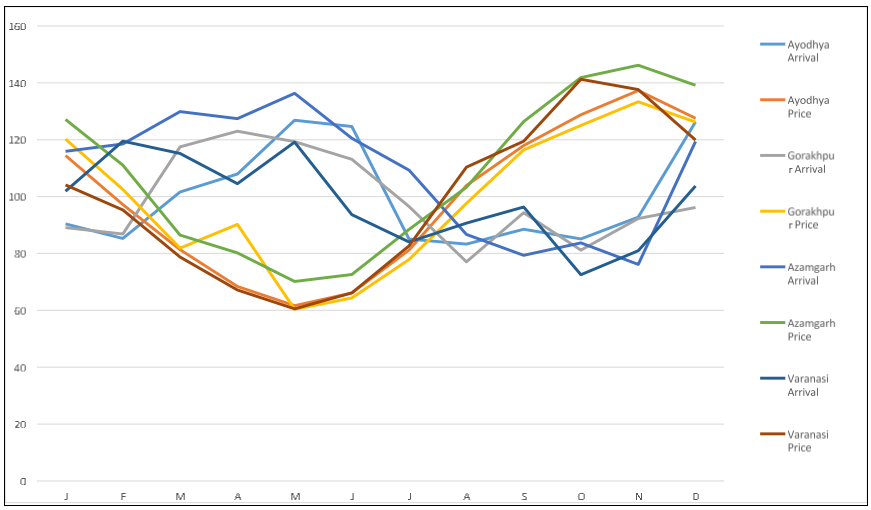

Fig 2: Seasonal Index of arrivals and prices of Onion in market of Eastern Uttar Pradesh 2005-06 to 2019-20

It is obvious form the graphs (Fig. 1) that arrivals and prices were inversely related with each other. If arrival increase prices decreases and vice-versa. It is also evident from the graph that price movement tended to be less than average from February to end of July as the index of the price variations was less than 100. From the months of August to January, the prices tended to be more than average as the index of price variations was higher than 100.

Irregular Fluctuations

After deducting the seasonal fluctuations in the arrival of onion from the moving averages irregular fluctuations have also been estimated. The irregular fluctuations in the arrivals of onion in different selected markets of eastern Uttar Pradesh is shown in Table-9

Table 9: Irregular fluctuation in arrivals of potato in market of eastern Uttar Pradesh 2005-06 to 2019-20

Year	Gorakhpur	Faizabad	Azamgarh	Varanasi
January	-1.04162	-0.20795	9.133852	-1.57406
February	-1.01526	-0.17771	9.337608	-1.84622
March	-1.37302	-0.21167	10.23848	-1.77935
April	-1.43747	-0.2249	10.04031	-1.61541
May	-1.39415	-0.26428	10.74305	-1.84061
June	113.0591	6.087823	9.496576	-1.44686
July	-1.12779	-0.17717	8.61218	-1.29804
August	-0.90072	-0.17353	6.832931	-1.40071
September	-1.10262	-0.18439	6.251762	-1.48809
October	-0.94896	-0.17735	6.598113	-1.12061
November	-1.0789	-0.1933	6.00085	-1.25082
December	-1.124	-0.26308	9.40659	-1.60264

It may be seen from Table- 9 that in Varanasi and Gorakhpur market the arrival of onion was mainly influenced by seasonal nature of arrival from January to December. In Ayodhya market the arrival of onion was quite low, i.e., -0.26428 quintals in the month of May followed by -0.26308 quintals in December and 0.21167 quintals in March, respectively. In other months the fluctuations in the arrivals were also found some-how low. This means the less arrivals were not due to seasonal behaviour but some other irregular factors were also responsible for the situation. Irregularity may cause due to perishability of the crop.

Conclusion

The study underscores the highly seasonal nature of onion marketing in Eastern Uttar Pradesh, with peak arrivals occurring between March and June, leading to significant price drops due to supply excess. Conversely, the price index rises from July to January as arrivals decrease, emphasizing the inverse relationship between supply and price. The irregular fluctuations in arrivals across different markets indicate the impact of external factors such as weather conditions, supply chain inefficiencies, and perishability of the crop. These insights highlight the pressing need for enhanced storage infrastructure, efficient supply chain management, and robust market intelligence to mitigate price volatility. Policy interventions focusing on post-harvest management, cold storage expansion, and farmer awareness programs on optimal marketing strategies can significantly improve price stability and farmer incomes. Future research should explore the impact of government interventions, trade policies, and technological innovations in onion storage and distribution to further stabilize market conditions.

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