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MARKET ARRIVAL AND PRICE BEHAVIOUR OF POTATO IN UTTARAKHAND

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ABSTRACT

An attempt has been made to study the market arrival and price behaviour of potato in Uttarakhand. The study is based on secondary data on wholesale monthly/weekly arrivals and prices for the period of 2003 to 2012. The seasonality in market arrival and wholesale price was analyzed using multiplicative model; the Fourier analysis was used to analyze cyclical variation in market arrivals and wholesale prices. Distribution lag model and Autoregressive model were used to study the relationship between market arrival and price of potato in major markets of Uttarakhand. It was found that during the post-harvest period, the wholesale price ruled very low while during the lean period, the prices were quite high which is due to seasonal and perishable nature of the potato. Most of the potato markets registered the positive and increasing trend in market arrivals and wholesale prices during the study period. The periodicities of 2, 3 and 4 years were observed in the market arrival and the periodicities of 2 and 3 years were observed in the wholesale price of potato in major markets of Uttarakhand. The effect of lagged price on current wholesale price was positively significant and high in magnitude and significant negative response was observed for the relationship between wholesale price and market arrival of potato in the major markets of Uttarakhand. Therefore, improved market information system is a need of efficient markets in Uttarakhand in order to enable farmers to make proper production and marketing decisions. Further, Government is required to create market infrastructure facilities like warehousing, processing, transportation, etc. for reducing the variation in prices of potato in the major market of Uttarakhand.

INTRODUCTION

Potato is the most important vegetable crop grown in the country. It is a high quality vegetable cum food crop. Potato (*Solanum tuberosum L.*) is an important horticultural crop of the world. It is an edible starchy tuber crop popularly known as 'The king of vegetables', has emerged as fourth most important food crop in India after rice, wheat and maize. Potato has edible protein content which makes it nutritionally superior vegetable as well as staple food not only in our country but also throughout the world. Potato is grown in more than 150 countries in the world with a production of around 373.52 million tonnes during the year 2011-12. The top five producers in the world are China, India, Russia, Ukraine and USA. China ranks first while India and Russia Federation rank second and third respectively. India contributes approximately 11 per cent of the world's total produce. India has always remained in the top ten since last twenty years.

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The area under potato cultivation in India was 2.30 million hectares with total production of 46.44 million tonnes in 2013-14 (NHB database 2013). Potato accounts for about 0.65% of the total cropped area of the country. It is grown in India in almost all the states and under very diverse conditions. Uttarakhand is blessed with a relatively clean and non-polluted atmosphere. Two thirds of the land mass is under forest cover. Several rare species of aromatic and medicinal plants are found in this state. Uttarakhand produces large varieties of cereals, fruits, vegetables and spices. Total area and production under potato is 25.0 thousand ha and 434.44 thousand tonnes respectively. Potato is an important vegetable crop cultivated in Uttarakhand. The marketable surplus of potato crop is quite high as compared to cereal crops. But the perishability and seasonality of potato crop is very high as compared to others crops. The price at all level of marketing fluctuates not only across the season in a year but also within the season. Their price fluctuations are largely attributable to change in their output and consequent changes in market arrivals. In agricultural commodities, volatility originates mainly from supply disturbances and these disturbances coupled with short-

run demand and supply elasticity give rise to acute price fluctuations. This leads to violent fluctuation in the arrivals and prices of potato over time and place that affects both producers and consumers. Therefore, the analysis of price behavior of potato is useful to take decisions like, "when to grow and when to sell" for the farmer and "when, where, how to store and dispose of the produce" for the seller. The instability in prices of agricultural commodities has been one of the major factors affecting the income levels of farmers as well as tempo of agricultural production. This instability in prices of agricultural commodities is influenced by a number of factors such as annual variation in production, low price elasticity of demand and seasonality of agricultural production (Kahlon and Tyagi, 1989). The behaviour of prices (in terms of price level, trend and fluctuation) is the most important factor in determining the competitiveness of the commodity in the domestic and international level and to draw inferences for future prices and to formulate long term strategy on trade (Chand, 2002). The present study was carried out to examine the trend in potato arrivals and prices in major market of state and to study the seasonal and cyclical variations in potato arrivals and prices in Uttarakhand.

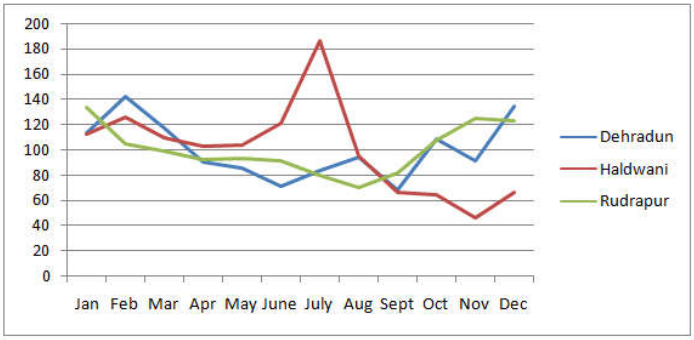

Figure 1. Seasonal Arrival Indices of Potato in Major Markets of Uttarakhand

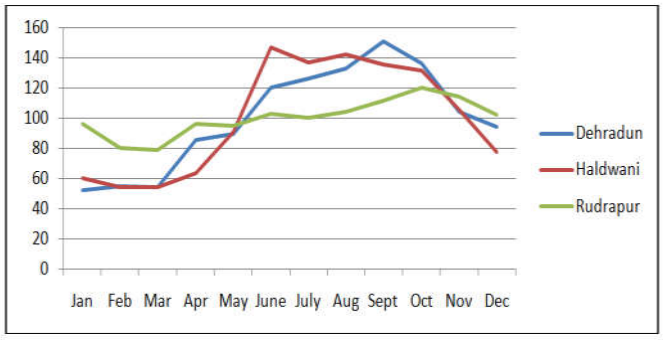

Figure 2. Seasonal Price Indices of Potato in Major Markets of Uttarakhand

Table 1. Estimated Trend Equations of Arrivals in Major Potato Market of Uttarakhand (Arrival in qt)

States	Major Potato Market	Intercept (a)	Regression Coefficient (b)	t-value	Standard Error of Coefficient SE (b)
Utatrakhand	Dehradun	1014.90	3.55*	2.77	1.28
	Haldwani	1764.34	-5.23	1.35	3.86
	Rudrapur	57.48	0.39*	4.33	0.09

* Significant at 5 per cent level of probability

Table 2. Estimated Trend Equations of Prices in Major Potato Market of Uttarakhand (Price in Rs per qt)

States	Major Potato Market	Intercept (a)	Regression Coefficient (b)	t-value	Standard Error of Coefficient SE (b)
Uttarakhand	Dehradun	339.57	2.27*	3.54	0.64
	Haldwani	363.81	1.82*	3.13	0.58
	Rudrapur	104.48	4.57*	12.35	0.37

* Significant at 5 per cent level of probability

MATERIALS AND METHODS

The study was conducted in Dehradun, Haldwani and Rudrapur market of Uttarakhand. These potato markets have been identified on the basis of maximum average monthly arrival of potato from the period 2009 to 2011. To achieve the stipulated objectives of the study the secondary and time series data were used. To compute the seasonal, trend and cyclical variation, monthly data on arrivals and prices for the years 2003 to 2012 were taken from the respective Agricultural Produce Market Committees (APMCs) of state as well as information available on Agmarknet portal. The arrival and price behaviour of potato was studied by computing the seasonal, trend and cyclical variation therein using a multiplicative model of following type:

$$Y_t = T_t \times S_t \times C_t \times I_t \quad \text{.....(1)}$$

Where,
Y_t = Time series data on wholesale prices/market arrivals of Potato (Rs per qtl/qtl)
T_t = Trend value at time t
S_t = Seasonal fluctuation at time t
C_t = Cyclic fluctuation at time t
R_t = Irregular fluctuation at time t

Equation (1) describes that the trend, seasonal, cycle and irregular components are multiplied together to give the observed series. Further, multiplicative decomposition is more prevalent with economic series because most seasonal economic series do have seasonal variation which increases with the level of series.The classical multiplication decomposition employed in the present analysis of arrival and price series of potato consisted of following steps:

The trend component was computed by fitting a trend line of the type Y=a+ bT+U to the observed time series on arrivals and prices. The de-trended series was computed by dividing the time series observations by estimated trend values, leaving the seasonal, cyclical and irregular terms. That is

$$\frac{Y}{a+bt} = St.Ct.It$$

After removing trend, seasonal component was estimated using 12-month moving average method. In classical decomposition, it was assumed the seasonal composition was constant from year to year. So, one value for each month was

to be calculated. The set of 12 values which were repeated to make up the seasonal component are known as the seasonal indices.

The de-seasonalized series was obtained by dividing the de-trended series by the indices of seasonal variation for corresponding period. That is

$$\frac{St.Ct.It}{St} = Ct.It$$

$$Y = a + bT + U$$

Where,

Y= arrivals and prices per month
T= Time period in months (T=1, 2… 120);
a=Slope coefficient
b= Regression coefficient
U=Error term

The equation was estimated using ordinary least squares techniques.

Table 3. Seasonal Indices of Arrivals and Prices of Potato in Major Markets of Uttarakhand

Months	Dehradun Market		Haldwani Market		Rudrapur Market	
	Arrival	Price	Arrival	Price	Arrival	Price
Jan	113.74	52.20	112.80	60.41	133.27	95.99
Feb	142	55.11	125.52	54.25	105	80.31
Mar	117.36	54.23	109.38	54.17	98.59	79.08
Apr	90.65	85.51	102.89	63.82	92.64	95.89
May	85.76	89.19	104	90.80	93.52	94.65
June	71.39	119.90	120.78	147.07	91.24	102.94
July	83.42	125.92	186	136.86	79.61	100.09
Aug	94.28	132.82	95.53	142.16	70.27	104.11
Sep	68.52	150.61	66.88	135.68	81.97	111.20
Oct	108.44	135.86	64.35	131.53	107.33	119.90
Nov	91	104.32	46.32	105.46	124.72	113.84
Dec	133.95	94.27	66.13	77.73	122.45	101.94

Note: All values are in term of indices.

Table 4. Periodogram Analysis of Prices and Arrivals in Major Potato Markets of Uttarakhand

Period (N)	Fourier Coefficients		Squared Amplitude	Mean Squared Amplitude	Ratio
	A_p	B_p	R^2_p	R^2_m	K
Dehradun					
Arrivals					
2	-724.87	451.57	729351.98	304279.43	2.39
3	715.54	647.21	930878.27		3.05
4	-54.50	78.54	9138.78		0.03
Prices					
2	474.24	293.50	311045.80	94067.14	3.30
3	80.07	-69.58	11252.58		0.11
4	-54.85	48.60	5370.48		0.057
Haldwani					
Arrivals					
2	-452.81	1247.51	1761318.09	1567311.95	1.12
3	846.74	741.27	1266449.84		0.80
4	-1622.71	1751.52	5701010.05		3.63
Prices					
2	-392.87	340.67	270402.90	70130.57	3.85
3	106.39	21.29	11772.10		0.16
4	75.97	-18.41	6110.36		0.087
Rudrapur					
Arrivals					
2	35.62	51.42	3912.80	1894.91	2.06
3	-65.84	54.61	7317.15		3.86
4	-32.50	31.40	2042.21		1.07
Prices					
2	-393.56	193.11	192180.9	62165.63	3.09
3	-36.34	12.51	1477.096		0.023
4	-23.49	341.42	117119.4		1.88

*Significant at 5 percent level of significance

Finally, the cyclical component Ct was computed from de-trended de-seasonalized series using fourier analysis. The irregular variations were assumed to be insignificant and were ignored. The above five steps of decomposition procedure were used to study the behaviour of arrivals and prices of potato. It is to mention that this procedure is detailed out for price series only as decomposition procedure is strictly same for arrival series also. To compute the trend component monthly wholesale prices and market arrival of potato for the period from 2003-2012 were utilized. A Simple linear trend equation of the following form was fitted to the arrival and price series.

The trend estimates (b's) were tested for their statistical significance using t-statistic. Trend values were derived using the trend equation and de-trended values were also obtained. The seasonality or seasonal indices was estimated by classical decomposition through ratio-to-moving average using monthly average prices. The detrended data was deseasonalised by dividing it by the seasonal indices. The Fourier analysis using trigonometric functions was used to uncover the hidden periodicity of the business cycles in a series. The time series data for the period of 9 years (2004 to 2012) were deseasonalised and detrended as a Fourier series.

Table 5. Estimated Regression Equation of Arrival on Price and Lagged Price in Major Potato Markets of Uttarakhand (Price in Rs per qt) (Arrival in qt)

States	Markets	Intercept (a)	Regression Coefficient (b)			Standard Error of Coefficient SE(b)			R^2
			Current Price (b)	One period Lagged price (c)	Two period Lagged price (d)	SE (b)	SE (c)	SE (d)	
Uttarakhand	DUN	2931.53	-2.79**	1.01	-0.57	1.54	1.96	1.54	0.13
	HLD	988.30	-0.70	1.38*	-0.89***	0.57	0.57	0.57	0.05
	RUD	65.92	-0.01	0.01	0.05	0.04	0.05	0.04	0.06

*Significant at 1 percent level of probability
*** Significant at 10 percent level of probability

Table 6. Estimated Regression Equation of Price on Lagged Price and Arrival in Major Potato Markets of North India (Price in Rs per qt) (Arrival in qt)

States	Markets	Intercept (α)	Regression Coefficient (b)			Standard Error of Coefficient SE(b)			R^2
			One period Lagged Price (β)	Two period Lagged price (γ)	Market arrival (δ)	SE (β)	SE (γ)	SE (δ)	
Uttarakhand	DUN	46.47	0.79*	0.136***	-.008***	0.081	0.082	0.005	0.89
	HLD	40.84	0.49*	0.499*	-0.016	0.076	0.076	0.013	0.86
	RUD	48.26	0.88*	0.032	-0.043	0.081	0.082	0.166	0.83

*Significant at 1 percent level of probability
*** Significant at 10 percent level of probability.

Table 7. Test of Serial Autocorrelation in Establishing Relationship of Price with Lagged Price (β) and Arrival in Major Potato Markets of Uttarakhand

States	Markets	Standard Error of Regression Coefficient of Lagged Price [SE(β)]	Variance of Regression Coefficient of Lagged Price[var(β)]	d-statistic	Estimate of First-order serial Correlation (ρ)	h-statistic
Uttrakhand	Dehradun	0.081	0.0065	1.957	0.0215	1.097
	Haldwani	0.076	0.0057	1.895	0.0525	1.535
	Rudrapur	0.081	0.0065	2.006	-0.003	-0.153

Note: Sample size (n) =144
Rejection of null hypothesis (ρ=0) when |h|>1.96 at 5 percent probability

Table 8. Test of Serial Autocorrelation in Establishing Relationship of Price with Lagged Price (□) and Arrival in Major Potato Markets of Uttarakhand

States	Markets	Standard Error of Regression Coefficient of Lagged Price [SE(γ)]	Variance of Regression Coefficient of Lagged Price [var(γ)]	d-statistic	Estimate of First-order serial Correlation (ρ)	h-statistic
Uttrakhand	Dehradun	0.082	0.0067	1.957	0.0215	1.448
	Haldwani	0.076	0.0057	1.895	0.0525	1.535
	Rudrapur	0.082	0.0067	2.006	-0.003	-0.202

Note: Sample size (n) =144
Rejection of null hypothesis (ρ=0) when |h|>1.96 at 5 percent probability

For analysis 3 periods of 2, 3 and 4 years of length were taken and squared amplitudes were computed for each specific period by findings the Fourier coefficients. The Fourier coefficients AP and BP were computed from above formulae for the trial period P (mP is N or the nearest integer below N):

$$x_t = A_p \cos\frac{2\pi t}{P} + B_p \sin\frac{2\pi t}{P}$$

Fourier coefficients,

$$A_p = \frac{2\sum_{t=1}^{P} Ut \cos\frac{2\pi t}{P}}{mP}$$

$$B_p = \frac{2\sum_{t=1}^{P} Ut \sin\frac{2\pi t}{P}}{mP}$$

$$U_t = \sum_{r=1}^{m} x_{t+(r-1)\,P}$$

The squared of amplitudes for trial period P was given as:

$$R_p^2 = A_p^2 + B_p^2$$

The hidden periodicities were found by using Schuster test Periodogram analysis. It was used to test the significance of the squared amplitude derived from Fourier analysis. The mean squared amplitude (R_m^2) was calculated under the assumption that there were no periodic fluctuation i.e. series were random following normal distribution.

$$R_m^2 = (4\alpha^2/N)$$

Where, α^2= variance of the original price series.

According to the test, the probability that the empirical squared amplitude (R_p^2) was k times the mean squared amplitude.

$$K = (R_p^2 / R_m^2)$$

The significant value of K at 0.05 probability level is 3.

The two dynamic econometric models namely Distributed lag model and Autoregressive model are used extensively in regressive analysis of time series data. If the regression model includes not only the current but also the lagged (past) values of the explanatory variables, it is called a distributed-lag model. The relationship between arrival, current price and lagged price of potato was based on weekly data of three years i.e from 2010 to 2012. Following functions along with their linear form are fitted to estimate the relationship.

$A_t = f(P_t, P_{t-1}, P_{t-2})$

$P_t = f(A_t, P_{t-1}, P_{t-2})$

The distributed lag model was used to find the effect of current and lagged prices on arrival. The model was specified as given below:

$A_t = a + bP_t + cP_{t-1} + dP_{t-2} + Ut$

Where,

P_t = Price of potato (Rs/qtl) in t^{th} week
P_{t-1} = Price of potato (Rs/qtl) in $(t-1)^{th}$ week
P_{t-2} = Price of potato (Rs/qtl) in $(t-2)^{th}$ week
A_t = Arrival of potato (qtl) in t^{th} week
a= intercept
b and c = slope coefficients
Ut = random term

In principal, the ordinary least square (OLS) was used to estimate the parameters and they were tested using t-statistic. This method of estimation is known as Ad Hoc Estimation of Distributed-lag model which assumed P_t, P_{t-1} and P_{t-1} to be non-stochastic. Similarly, if the model includes one or more lagged values of the dependent variable among its explanatory variables, it is called an autoregressive model. The autoregressive model had been used to find the effect of arrival and lagged price on current price of potato.

$P_t = \alpha + \beta P_{t-1} + \gamma P_{t-2} + \delta A_t + U_t$

Where,

P_t = Price of potato (Rs/qtl) in t^{th} week
P_{t-1} = Price of potato (Rs/qtl) in $(t-1)^{th}$ week
P_{t-2} = Price of potato (Rs/qtl) in $(t-2)^{th}$ week
A_t = Arrival of potato (qtl) in t^{th} week
α = intercept
β, γ and δ = slope coefficients
Ut = random term

The parameters were tested using t-statistic. In this case, classical least squares method is not applicable because if an explanatory variable in a regression model is correlated with the stochastic distribution term, the OLS estimators are not only biased but also not even consistent. Further, the serial correlation in the errors, make the estimation problem in the autoregressive model complex. Durbin h test was applied as proposed for a large sample test of first-order serial correlation in autoregressive model.

$$h=\rho\sqrt{\frac{n}{1-n[var(\beta)]}}$$

Where, n= Sample size

$var(\beta)$=Variance of the lagged price (P_{t-1}) coefficient
ρ= Estimate of first order serial correlation

The d value from Durbin-Watson test was used to calculated ρ

$\rho \approx \{1-(d/2)\}$

Criteria: If |h|>1.96, reject the null hypothesis that ρ=0, i.e there is evidence of first-order autocorrelation in above given autoregressive model.

RESULTS AND DISCUSSION

Trend in arrivals and prices of potato

Trend is that component of time series which reveals the general direction of change over a longer period of time. This component is affected by factors inducing changes in demand such as change in population, income, habits, and customs. Price trend is also affected by adjustment in supply arising out of development of cold storage, processing and marketing facilities, production techniques and market arrivals over a long period. However, the variations in arrivals depend upon the changes in production incentives, etc. In the present section an attempt has been made to fit simple linear trend equations to know the general tendency of arrivals and prices to rise or fall over a long period of time. Trend equations in arrivals and prices of potato have been estimated from monthly arrivals and prices. The equations were estimated for arrival and price series for 120 months i.e. January 2003 to December 2012. The results are presented in Table 1 and 2.

The trend equations fitted for potato arrivals for different markets are presented in Table 1.The table reveals that the trend coefficients were significant for all major markets of Uttarakhand. Positive trends in potato arrivals have been noticed for majority of potato markets. The arrival trend equation showed that the potato arrivals in Dehradun market increased by about Rs. 3.55 qtl per month during the study period. The table reveals that the trend coefficients were significant for all major market of potato. It is noticed in the table that arrival of major markets of potato has been found increasing over time. But Haldwani market are showing decreasing trend over time. The pattern of arrival during the study period revealed that there was a decrease of about 5.23qtl of potato during the study period in Haldwani wholesale market though non-significant. The estimated trend equations of prices of potato for different markets are presented in Table 2. The table reveals that the trend coefficients were significant for all markets of potato. It is further noticed in the table that potato prices in all markets have been found increasing over time.

The table further reveals that the intercept and co-efficient for prices in Rudrapur market was estimated to be 104.48 and 4.57 respectively, which were found to be statistically significant. The potato prices were rising more rapidly in Rudrapur market. In Rudrapur markets prices have risen, on average, at a rate of Rs. 4.57 during the study period. The positive trend for wholesale prices of potato along with increasing potato arrival indicated that the increase in demand for potato in these markets out weighted the effect of increase in supply, resulting in net increase in potato price over time. The demand for potato in these markets has been increasing due to various reasons like increasing population, general price rise etc.

Seasonal variations in potato arrivals and prices

Seasonal fluctuations are the changes that occur regularly every year during the same period. The seasonal changes are caused mainly by such factors as climate and weather conditions, customs, traditions and habits. The seasonal indices of arrivals and prices would show the extent of fluctuations in arrivals and prices from month to month and may be helpful to indicate the optimum time for sale of the produce. These variations may be primarily due to seasonal production, poor cold storage facilities in case of less perishable product and lack of retention power of potato growers. The seasonal indices of arrivals and prices of potato in major markets of Uttarakhand are given in Table 3. The three major markets of potato in Uttarakhand are Dehradun, Haldwani and Rudrapur. Seasonal Arrival Indices of potato in Dehradun, Haldwani and Rudrapur markets are represented in Table 1 and Figure 1.

The table depicts that the highest arrivals of potato in Haldwani market was observed in the month of July (186 per cent) at same time the price was also highest, due to the trade in hill potato, which is relatively highly priced being off-season, and exported to other regions. The potato prices showed that the arrival were the peak during January-July in Haldwani market while Dehradun and Rudrapur markets the arrival were peak during December-March. Farmers might get a good return, if they were able to retain potato and offered for sale between June and November. Seasonal Price Indices of potato in Dehradun, Haldwani and Rudrapur markets are represented in Table 1 and Figure 2. Seasonal Indices in three markets exhibited similar pattern in potato prices except minor difference in magnitude for the peak and troughs. The potato prices showed that the prices were the peak during June-September in Haldwani market. Because at that time hill potato come in the market and price was high as compared to plain potato. While in Dehradun and Rudrapur markets the prices were peak during September-November. In general, the prices were high from June to November and low in December to May in all the markets.

Cyclical variation in arrivals and prices of potato

In order to estimate the fourier coefficients, three periods of length 2, 3 and 4 years were taken and the squared amplitudes were computed for each specific period. The results of periodogram analysis for potato arrivals indicate that in potato production, cycles of different periods were found to exist in major markets of Uttarakhand (table 4). Arrivals of potato followed Kitchin cycle and Juglar cycle having a significant periodicity of 3 and 4 years. Dehradun and Rudrapur markets, the value of k for trail period of 3 years were more than 3, significant at 5 percent level. While, the Haldwani markets the value of k for trail period of 4 years were more than 3 as obtained which was significant at 5 percent level. Arrivals of potato followed Kitchin cycle having a significant periodicity of 2 years. In some major markets of Uttarakhand such as Dehradun, Haldwani and Rudrapur markets, the value of k for trail period of 2 years was more than 3, significant at 5 percent level which showed that prices of potato followed Kitchin cycle having a significant periodicity of 2 years. Thus, the period gram analysis of time series of prices of potato showed that the regular cycles of longer duration viz, Kitichin cycles for prices with a periodicity of 2 years and Juglar cycles for arrivals with a periodicity of 4 years. To save both producers and consumers from the fluctuation in prices within the particular season, efforts should be made to reduce the intra year price spread. Setting up of more number of processing units along with storage facilities can reduce the price variations. The seasonal relationship between the arrival, current price and lagged price in major potato market of Uttarakhand were based on the weekly statistics for a period of three years viz., 2010 to 2012. The econometric models known as distributed lag model and autoregressive model were used to analyze the relationship between current price, lagged price and arrival of potato. The following abbreviation were used for each markets: Dehradun (DUN), Haldwani(HLD), Rudrapur (RUD). The results are presented in Table 5 and 6.

The Table 5 represents the relationship of arrival with current price and lagged price of potato. It was revealed that for perishable commodities like potato, if market arrival was regressed on concurrent or lag weekly price, the results are spurious one. In other words, weekly prices were not capable to influence grower's decision to sell the produce during post harvest season under the present circumstances. This inference was based on negative values of regression coefficients obtained in almost all potato market of Uttarakhand. While few markets also shows non-significant values of regression coefficients. As hypothesized, market price is found negatively influenced by market arrival for all potato market of Uttarakhand. The relations, however, do not appear to be strong enough in view of low values of r^2 in most of the cases.

The Table 6 gives the relationship of current price with lagged price and market arrival of all major potato markets of Uttarakhand. As the serial correlation in the error term makes the estimation in autoregressive model rather complex, a large-sample test of first-order serial correlation known as h statistic was applied. The result of h statistic presented in Appendix 1 and 2. The table reveals that there was an absence of positive autocorrelation. The table 6 depicts that the positive response of lagged price of potato to its current wholesale price was highly significant. The maximum change in current price due to one week lag price was observed. Further, the current price of potato responded negatively to its market arrival. The result revealed that grower's decision to sell the produce was also based on current market arrival and lag weekly price of potato. This indicated the presence of imperfection in marketing of potato as the traders used the previous week price as a guide for setting the current price of potato, instead of current market arrival and demand.

Conclusion

The results found from this research showed reasonably a high degree of seasonality in the wholesale prices of potato. However, continuity in seasonality in prices was affected because of arrival of potato in Uttarakhand from different agro-climatic regions due to which seasonality got smoothened. The trend analysis showed that all major markets of potato had a positive increasing trend in prices of potato during the study period which indicated that irrespective of increase in supply the price also increased, due to faster rate of growth in demand than supply. The wholesale price series of Potato in market followed the Kitchin cycle having significant periodicity of 2 years. While, arrivals of potato followed Kitchin cycle and Juglar cycle having a significant periodicity of 3 and 4 years. The irregular component, however, is difficult to predict and it differed for prices series among

various selected crops. The relationship between wholesale price and market arrival of all the major markets of potato showed a negative relationship. Further, it was observed that there was absence of positive autocorrelation. Therefore, the effect of lagged price on current wholesale price was positive, high in magnitude and significant for all the selected potato markets. This indicated imperfection in marketing of potato in major markets of Uttarakhand as the traders used the previous week price as guide for setting the current price of the potato, instead of current market arrival and demand.

Therefore, it may be concluded from the study that the seasonality in the arrivals and prices of potato was more conspicuous in all selected potato markets. In general, the prices were observed to be low in post harvest period and high in lean period. The arrival, on the other hand, created glut like situation in the markets which led to sharp fall in the prices during the post harvest season and affected the producers adversely. To save producers from the seasonal price fluctuations, efforts should be made to minimize the intra year price spread. In this context, there is a need to create market infrastructure facilities like warehousing and processing. Setting up of processing units along with storage facilities can reduce the price variation to great extend. The effective use of warehousing facilities and credit to the producer-seller against warehouse receipts would go a long way in avoiding seasonal variations in arrivals and prices.

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