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TRENDS IN MARKET ARRIVALS AND PRICES OF GARLIC IN SELECTED APMC MARKETS OF GUJARAT

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ABSTRACT

Garlic (*Allium sativum* L.) is one of the important vegetable cum spice crop along with medicinal properties with the huge production concentrated in the Saurashtra area of Gujarat. The present study was done to examine the trends in market arrivals and prices of garlic in three major markets of Gujarat i.e., Rajkot, Jamnagar and Gondal for the period from 2011 to 2025, using secondary source data collected from the APMC. Linear trend analysis and Compound Annual Growth Rate was calculated separately for each month and market. The results from the data revealed a significant positive linear trend in garlic prices across all three markets, with Rajkot recording the highest annual price increase (Rs. 429.84/quintal/year), followed by Gondal (Rs. 393.80/quintal/year) and Jamnagar (Rs. 331.19/quintal/year). But the arrivals data showed no significant trend, with negative regression coefficients in all three markets. Monthly CAGR of prices was positive and highly significant across all months in every market, with December consistently recording the highest growth rate. CAGR of arrivals revealed March had a significant decline in all markets while July and December showed positive growth in Jamnagar. Strengthening post-harvest storage infrastructure, farmer aggregation through FPOs and market intelligence systems are recommended to reduce price volatility and improve farmer returns.

Key words: Garlic, Market arrivals, Price trends, CAGR, Linear trend

Introduction

Garlic (*Allium sativum* L.) belongs to the Alliaceae family which is having the chromosome number of $2n = 32$, is one of India's most valued bulb crops, known for its distinct aroma due to the compound 'Allicin' which is formed enzymatically from the colourless amino acid 'Alliin' when cloves are crushed. Its primary flavouring agent is 'Diallyl disulfide', a pyruvate derivative (Freeman, 1975). The crop holds both nutritional and economic significance. Beside nutritional benefits it is the major spice used in many dishes in India to enhance test to the food. China is the largest producer of garlic followed by India. In India the area and production of garlic is 4.19 lakh ha and 35.65 lakh MT. In Gujarat, the area under garlic cultivation is of 14,228 ha with a total production of

1,16,481 MT. Saurashtra-Kutch region of Gujarat state alone contributes for over 90 per cent of the state's garlic area (12,836 ha) and production (1,06,616 MT), where Rajkot is the leading market for garlic in Gujarat state. Agricultural prices are considered has a reflection of a country's economy and in garlic which is having high seasonal concentration of production, perishability and limited cold storage access price volatility poses a serious threat to farm income and investment decisions (Rastogi and Athaley, 2019). Farmers will often sell at distress prices when they are lacking with reliable information on price trends and foregoing the potential premium of the lean season. An understanding of how garlic prices and arrivals have moved over time across key markets is therefore essential for farmers, traders, APMC authorities

and policymakers. Considering these points the present study examines the linear trend and compound annual growth rates in garlic prices and arrivals across three major markets of Gujarat-over the past 15 years.

Materials and Methods

The study was conducted in Gujarat which is one of India's leading garlic producing states. On the basis of the highest volume of garlic arrivals Rajkot, Jamnagar and Gondal APMC markets were purposively selected. The study was based on secondary data comprising monthly market arrivals (in tonnes) and modal wholesale prices (in Rs./quintal) for a period of 15 years from 2011 to 2025. Data was collected from the records maintained by the APMCs. Modal price was used in preference to average price, as it represents the price at which the largest volume of the commodity was traded in a given month, making it more suitable of prevailing market conditions. To study trends in garlic prices and arrivals Linear trend analysis and Exponential trend analysis was carried out and the data was analysed through MS Excel.

(a) Linear Trend Analysis: To assess the direction and magnitude of change in annual prices and arrivals over time, a simple linear regression equation of the following form was fitted (Singh and Sekhon, 2017):

$$Y = a + bt$$

Where,

Y is the dependent variable (annual average price in Rs./quintal or annual total arrivals in tonnes), t is the time variable in years, a is the intercept and b is the regression coefficient (slope) representing the average annual change. The significance of b was tested using the F-test at 1%, 5% and 10% levels. The coefficient of determination R^2 was used to assess the goodness of fit.

(b) Compound Annual Growth Rate (CAGR): To measure the rate of growth in prices and arrivals for compounding over time, the exponential trend model was used (Singh and Sekhon, 2017).

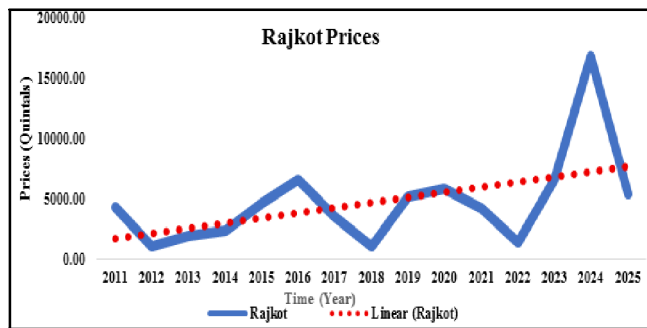


Fig. 1: Trend in Prices of Garlic in Rajkot Market.

Table 1: Linear Trend in Prices of Garlic in Selected Markets of Gujarat (2011 to 2025).

Market	Intercept (Rs/qrtl)	Regression Coefficient	p-value	R ²
Rajkot	1274.97 (1877.42)	429.84* (206.49)	0.057	0.25
Jamnagar	2076.36 (1467.20)	331.19* (161.38)	0.060	0.24
Gondal	1380.62 (1853.80)	393.80* (203.89)	0.075	0.22

Note: * Significant at 10% level of significance; figures in parentheses indicate standard error.

$$Y = ab^t$$

Where,

Y is the price or arrivals, a is the intercept, b is the regression coefficient and t is the time variable. The CAGR was computed separately for each month using the formula:

$$\text{CAGR (\%)} = (\text{Antilog } b - 1) \times 100$$

Monthly CAGR were estimated to capture whether prices or arrivals in a particular month of the year have been systematically rising or falling across years. The statistical significance of CAGR was tested using the t-test:

$$t = b / \text{SE}(b)$$

Where,

b is the regression coefficient of the exponential trend and SE(b) is its standard error. Significance was tested at 1%, 5% and 10% levels.

Results and Discussion

Linear Trend in Prices of Garlic in Selected Markets

Table 1 represents the estimates of linear trend in annual garlic prices across the selected APMC markets. The regression coefficient b, associated with the time variable was positive and significant in all markets which confirmed a consistent upward movement in garlic prices over the last 15-years. Rajkot recorded the highest annual price increase at Rs. 429.84 per quintal per year, followed

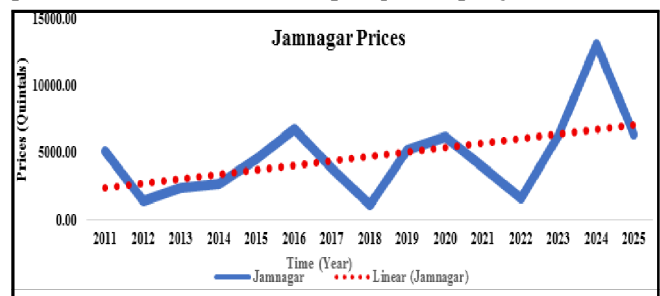


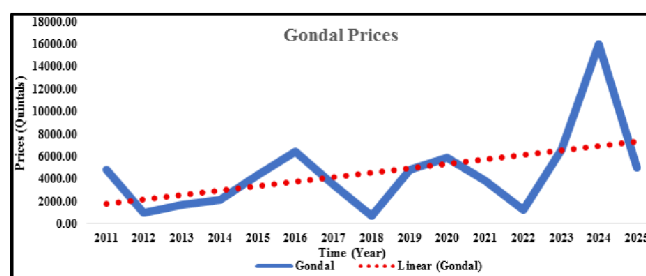
Fig. 2: Trend in Prices of Garlic in Jamnagar Market.

Table 2: Linear Trend in Arrivals of Garlic in Selected Markets of Gujarat (2010-11 to 2024-25).

Market	Intercept (tonnes)	Regression Coefficient	p-value	R ²
Rajkot	22648.52 (3820.62)	-42.31 (420.21)	0.92	0.001
Gondal	45514.73 (6024.37)	-939.13 (662.59)	0.17	0.134
Jamnagar	17152.32 (4424.27)	-31.57 (486.61)	0.95	0.0003

Note: Figures in parentheses indicate standard error.

by Gondal and Jamnagar. The intercept values indicated that in the base period, prices in Jamnagar were higher than in Rajkot and Gondal which reflects its market structure and demand from a larger consumer population. However, Rajkot's steeper slope suggests that its market has been catching up rapidly and likely driven by growing buyer competition, better connectivity and rising demand from processing and export segments. The R² values ranged from 0.22 to 0.25 which indicated that the linear time trend accounts for approximately one fourth of the total price variation, with the remaining variation attributable to seasonal fluctuations, crop-year supply shocks and market-specific factors. The significance of the upward price trend despite modest R² is consistent with the widely recognized phenomenon of agricultural commodity price inflation in India, driven by rising input costs, increasing demand and inelastic supply. Similar positive price trends were reported by Kundu *et al.*, (2019), Saha *et al.*, (2020), Thakur *et al.*, (2022), Chavan *et al.*, (2023) and Shankar *et al.*, (2025). The Fig. 1 shows the price trend of garlic market in Rajkot whereas Fig. 2 and Fig. 3 shows the price trends in Jamnagar and Gondal market.

**Fig. 3:** Trend in Prices of Garlic in Gondal Market.

Linear Trend in Arrivals of Garlic in Selected Markets

Table 2 represents the linear trend in annual garlic arrivals across the three markets. Unlike prices, garlic arrivals showed no significant trend in any of the three markets over the study period. The regression coefficients were negative for all markets with Rajkot (-42.31), Gondal (-939.13) and Jamnagar (-31.57). The R² values were extremely low (0.001 to 0.134) which confirmed that time alone explains virtually no variation in market arrivals. Gondal showed the largest decline in arrivals per year among the three markets, though even this was not significant. The marginal negative slopes across all markets reflected a several factors such as diversion of produce to newer market centres in the region, increased share going to cold storage and processing units rather than direct APMC sales or some degree of area stagnation in garlic cultivation in adjacent districts. The combination of a significant positive price trend alongside non-significant and slightly declining arrival trends is an important finding, suggesting that the price rise in garlic is more supply-driven than demand-driven rising prices are not being accompanied by a corresponding growth in marketed surplus reaching these markets. A similar results between positive price growth

Table 3: Month wise CAGR of Garlic Prices in Selected Markets of Gujarat (2011–2025).

Month	Rajkot		Jamnagar		Gondal	
	CAGR (%per annum)	Std. Error	CAGR (%per annum)	Std. Error	CAGR (%per annum)	Std. Error
January	5.52***	1.07	5.70***	0.99	5.38***	1.16
February	6.94***	0.97	2.45**	0.84	8.25***	1.11
March	7.59***	0.72	3.94***	0.50	8.19***	0.89
April	9.06***	0.49	5.09***	0.48	9.71***	0.65
May	8.88***	0.58	7.39***	0.54	8.56***	0.63
June	8.02***	0.66	7.02***	0.61	7.75***	0.68
July	8.86***	0.68	8.04***	0.60	8.43***	0.73
August	8.34***	0.76	7.90***	0.66	7.29***	0.79
September	8.31***	0.88	6.08***	0.80	8.13***	0.98
October	8.68***	0.97	6.80***	0.83	7.86***	1.04
November	8.61***	1.03	7.65***	0.91	8.12***	1.10
December	10.91***	0.98	9.84***	0.86	10.24***	1.07

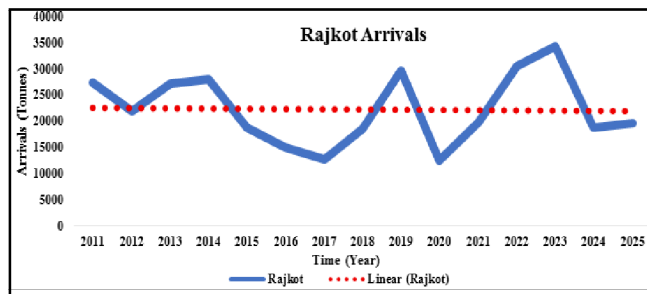
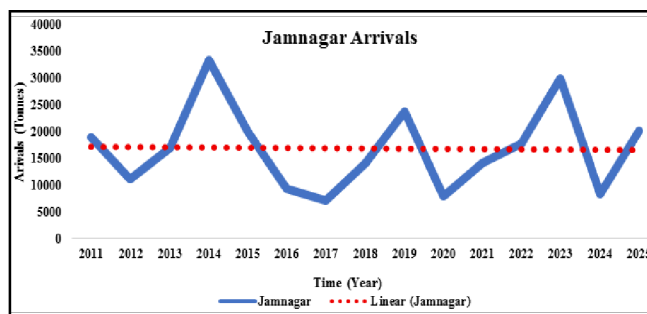
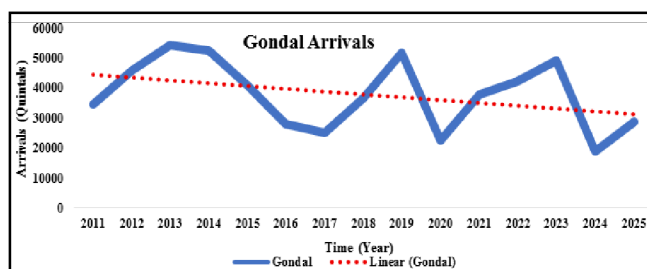
Note: *** Significant at 1% level; ** Significant at 5% level

Table 4: Month wise CAGR of Garlic Arrivals in Selected Markets of Gujarat (2011–2025).

Month	Rajkot		Jamnagar		Gondal	
	CAGR (%per annum)	Std. Error	CAGR (%per annum)	Std. Error	CAGR (%per annum)	Std. Error
January	0.39	0.56	1.30	0.88	-0.40	0.46
February	2.32**	0.65	-2.14	1.34	-3.81***	1.10
March	-2.98***	0.51	-7.77***	0.67	-5.38***	0.74
April	1.06**	0.42	-3.33***	0.59	-3.62***	0.42
May	-1.22	0.49	-4.75***	0.69	-3.03***	0.36
June	-2.60***	0.41	1.18*	0.67	-0.87	0.56
July	0.82	0.55	4.43***	1.02	1.52*	0.76
August	-1.57***	0.50	0.96	0.75	0.78	0.78
September	-1.10**	0.47	-0.33	0.61	4.24***	0.66
October	-2.38***	0.39	-1.93***	0.53	-3.23***	0.36
November	-0.03	0.49	1.48**	0.66	-1.45***	0.44
December	-0.56	0.57	3.61***	0.61	-4.27***	0.54

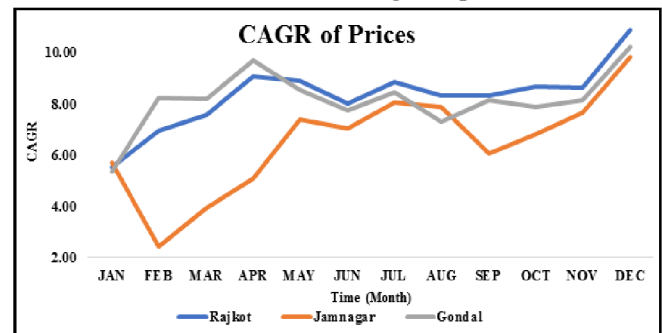
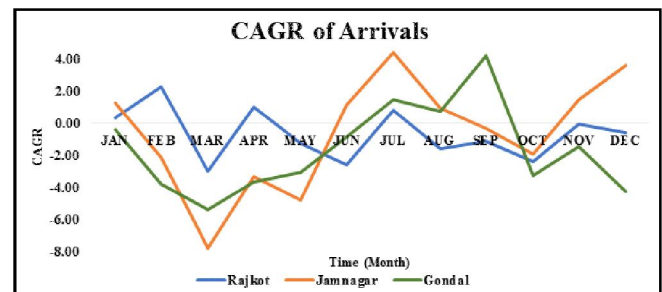
Note: *** Significant at 1%; ** Significant at 5%; * Significant at 10%.

and relatively stagnant arrivals was observed by Kumuda (2012), Kaur *et al.*, (2020), Meena *et al.*, (2020), Chavan *et al.*, (2023). Fig. 4 depicts the Trends in Arrivals of garlic in Rajkot market whereas Fig. 5 and Fig. 6 depicts the Trends in arrivals of Garlic in Jamnagar and Gondal market.

**Fig. 4:** Trend in Arrivals of Garlic in Rajkot Market.**Fig. 5:** Trend in Arrivals of Garlic in Jamnagar Market.**Fig. 6:** Trend in Arrivals of Garlic in Gondal Market.

Compound Annual Growth Rate (CAGR) of Garlic Prices

Table 3 represents the month wise CAGR of garlic prices calculated for each month across all three markets. All month wise CAGRs were positive and significant in selected market which confirmed that garlic prices in Gujarat have been raised systematically in every month of the year over the study period. December recorded the highest CAGR in all three markets with 10.91 per cent in Rajkot, 10.24 per cent in Gondal and 9.84 per cent in Jamnagar reflecting a strong and growing off-season price premium in the month when garlic supply from domestic production was leanest and storage-released stocks command the highest price. The month

**Fig. 7:** CAGR of Garlic Prices in different markets.**Fig. 8:** CAGR of Garlic Arrivals in different markets.

of December followed by April which recorded high growth in prices of Garlic in Rajkot and Gondal market during the study period. January recorded the lowest CAGR values across all markets which is the period of peak fresh garlic arrivals when supply abundance moderates the pace of price growth. Jamnagar consistently showed lower month wise CAGRs than Rajkot and Gondal across most months particularly in February and March suggesting that its market may have better price stabilisation mechanisms. Gondal showed the highest CAGR in February and April among the three markets. These findings were similar with Daundkar *et al.*, (2015), Selvi *et al.*, (2020), Gholap *et al.*, (2021), Thakur (2023) and Shankar *et al.*, (2025) who found the highest monthly garlic price growth in North India during the off-season months of November, April and December. The Fig. 7 shows the CAGR of Garlic prices in selected markets of Gujarat.

Compound Annual Growth Rate (CAGR) of Garlic Arrivals

Table 4 represents the month wise CAGR of garlic arrivals in the three markets and the results revealed a mixed pattern with several negative and non-significant values, pointing to structural shifts in how garlic reached the market over the study period. March is the primary harvest arrival month for garlic in Gujarat and recorded a highly significant and large negative CAGR in all three markets. This consistent decline in peak-harvest arrivals at these markets suggested that farmers and traders were progressively diverting fresh garlic away from these traditional APMC yards, possibly towards cold storage facilities, direct procurement by processors or emerging mandis. October also showed a significant negative CAGR across all markets which indicated a declining trend in post-storage releases reaching the markets. Gondal showed the most persistent pattern of declining arrivals with significant negative CAGR in February to May and October to December suggesting that it has experienced the greatest diversion of garlic trade away from its APMC yard. Jamnagar revealed significant positive arrival CAGR in December and July which indicated off-season garlic supplies likely from storage holders have been growing at this market over the years. Rajkot showed a significant positive arrival CAGR in February and April while recording significant declines in March, June and August to October. The contrast between a highly significant and positive price CAGR and a largely stagnant or declining arrival CAGR across all three markets is the most important empirical finding of this study. Similar results were revealed by Daundkar *et al.*, (2016), Kaur *et al.*, (2020), Chavan *et al.*, (2023).

The Fig. 8 shows the CAGR of Garlic arrivals in selected markets of Gujarat.

Conclusion

From the present study it was observed that during 2011 to 2025, Garlic prices had significant positive linear trend in all the three selected markets i.e. Rajkot, Jamnagar and Gondal, implied that the prices of garlic increased over the period of time. In contrast, market arrivals of garlic showed negative and non-significant trend across all selected markets. Month wise CAGR of garlic prices was positive and significant in all twelve months across all the selected markets indicated that the prices of garlic increased significantly throughout the year during study period. Among the months, December consistently recorded the highest CAGR pointing to a persistent and growing off-season price premium. The growth rate of market arrivals of garlic found mostly negative in majority of months in selected markets indicated that the arrivals of garlic declined during the study period. CAGR for arrivals was highly variable with March showing the sharpest and most consistent decline suggesting progressive diversion of peak-harvest produce away from traditional APMC channels. The growing divergence between rising prices and stagnant arrivals at these markets indicates that supply constraints rather than rising demand are the primary driver of garlic price inflation in Gujarat. These findings highlight the urgent need to invest in post-harvest infrastructure particularly cold storage linked to APMC yards, grading and sorting facilities and farmer-level aggregation through FPOs to regularise garlic supply to markets across seasons and moderate price extremes. Simultaneously, strengthening real-time market intelligence and price information dissemination would enable farmers to make better-informed decisions on when and where to sell their produce and improving their share of the consumer's rupee.

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