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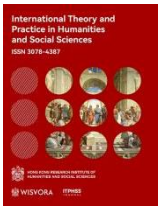

Correlation Analysis Between Ambient Temperature and Ice Cream Sales: An Empirical Study Based on a Simple Linear Regression Model and Strategic Recommendations for the Industry

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Abstract

This study examines the interplay between environmental temperature patterns and ice cream market dynamics using nationwide meteorological records and sales data spanning 2023 to 2024. By developing a quantitative analytical framework, the research demonstrates a measurable transmission mechanism through which thermal variations influence consumer purchasing behaviors. The analysis positions climate change as a pivotal factor reshaping seasonal demand cycles for temperature-dependent products, offering fresh perspectives on climate-economic interdependencies. Methodologically, while validating core analytical assumptions, the study acknowledges the necessity of addressing microenvironmental heterogeneities and non-climatic variables that may mediate observed relationships. Three strategic recommendations emerge from the systemic investigation: implementing weather-predictive supply chain coordination systems, fostering product innovation aligned with sustainability trends and health-conscious consumption, and formulating climate-resilient policy frameworks for industry governance. These findings advance climate adaptation strategies in the food sector, emphasizing the imperative to harmonize market expansion objectives with ecological stewardship. The study advocates for future research integrating multi-source environmental and socioeconomic datasets to better capture the complexity of climate-driven market transformations. Practical implications extend to inventory optimization, green product development, and policy interventions that bridge meteorological forecasting with commercial decision-making processes.

1. Introduction

The global ice cream market is undergoing significant transformation driven by evolving consumer preferences and environmental changes. Recent years have witnessed growing demand for functional foods with enhanced nutritional profiles, prompting manufacturers to incorporate bioactive compounds and health-promoting ingredients into frozen desserts. Concurrently, climate change has emerged as a critical external factor influencing consumption patterns, with rising global temperatures potentially altering seasonal demand dynamics for temperature-sensitive products. This dual pressure of market innovation and environmental shifts

creates a complex landscape for industry stakeholders requiring evidence-based insights.

This study specifically examines the interplay between climatic variables and commercial performance in the ice cream sector, with particular focus on temperature-sales correlations. Through quantitative analysis of historical market data, the research seeks to establish measurable patterns linking meteorological conditions to consumer purchasing behavior. The findings aim to equip manufacturers and investors with predictive tools for inventory management, regional market expansion, and climate adaptation strategies. Furthermore, the analysis contributes to broader discussions about climate-economic interactions within the food industry.

The investigation spans market data from 2023 to 2024, encompassing periods of both gradual warming and extreme weather events. Methodologically, linear regression analysis serves as the primary analytical tool to model relationships between temperature fluctuations and sales revenue, following established practices in climate-economic research. This approach enables quantification of temperature's predictive value while controlling for baseline market growth trends. Historical sales data were sourced from verified industry reports, while temperature records were obtained from the National Oceanic and Atmospheric Administration's Global Historical Climatology Network.

Several important limitations qualify the study's conclusions. The analysis presupposes linear relationships between temperature and sales, potentially overlooking threshold effects or regional consumption habits. As noted in food marketing literature, economic variables including disposable income levels and promotional activities may interact with climatic factors in complex ways not captured by the current model. Additionally, the homogenization of global climate data risks obscuring localized microclimate variations that could influence regional sales patterns. These constraints highlight the need for complementary qualitative research to fully contextualize the quantitative findings.

2. Literature Review

The global ice cream market is increasingly affected by the dual forces of changing consumer preferences and environmental variables, particularly climate change. This review synthesizes recent research on the interplay between climatic conditions and commercial performance in the ice cream sector, with a focus on temperature-sales correlations.

Research highlights the sensitivity of consumer purchasing behavior to climatic conditions. A study on the economic impact of climate change in Southern Nigeria demonstrated significant correlations between temperature, rainfall, and the sales of temperature-sensitive products like ice cream. Sales increased during the dry season and decreased during rainy periods, suggesting that climate variables directly influence consumer demand (Odjugo & Atedhor, 2006). Further supporting this link, a multiple regression analysis conducted in Port Harcourt, Nigeria, confirmed that both rainfall and temperature are strong predictors of product sales. The study revealed that higher temperatures correlated with increased ice cream demand, emphasizing the need for climate-informed inventory management strategies (Efe & Weli, 2015). More recent studies reinforce these findings, indicating that as global temperatures continue to rise, ice cream sales exhibit seasonal peaks aligned with hotter periods, particularly in urbanized areas where the heat island effect is prominent (Rao, Sharma & Raghuraman, 2023).

Beyond consumer behavior, climate change impacts the production side of the ice cream industry. A comprehensive life cycle assessment of ice cream products revealed that environmental factors, particularly energy-intensive storage and refrigerant use, contribute

significantly to the product's carbon footprint. Long storage durations and the type of refrigerant used are primary contributors to environmental impact (Konstantas et al., 2019). Newer research highlights the increasing demand for sustainable ingredients and production methods to reduce environmental impact, with manufacturers exploring plant-based alternatives and energy-efficient processing techniques (Wróbel-Jędrzejewska & Polak, 2023).

The complexity of consumer responses to climate change extends beyond direct temperature effects. Consumers require substantial assistance in adopting climate-friendly behaviors, as highlighted by recent behavioral science research. Effective strategies include making climate-conscious choices more accessible and enhancing awareness through targeted communication campaigns (Thøgersen, 2021). Such interventions can help align consumer behavior with climate adaptation goals, ensuring more predictable demand for seasonal products like ice cream. Additionally, research has shown that as climate concerns grow, consumers are increasingly interested in sustainable and low-carbon food choices, influencing purchasing behavior and brand loyalty (Lavudya & Prabhakar, 2024).

Studies in Greenland further reveal that climate anomalies significantly influence consumer expenditure. Temperature changes and other climatic variables are substantial determinants of consumer spending patterns on non-durable goods, highlighting broader economic impacts beyond seasonal fluctuations (Affuso, 2019). These findings align with recent studies indicating that climate change affects consumer discretionary spending, particularly for temperature-sensitive goods such as frozen desserts (Filazzola et al., 2024). Such insights are crucial for ice cream manufacturers seeking to anticipate and respond to climate-induced demand variability.

Overall, the research underscores the significant role climate change plays in shaping ice cream consumption patterns and production strategies. As environmental concerns become more central to consumer and corporate decision-making, adapting to these changes will be crucial for the long-term sustainability of the industry.

3. Data

3.1 Data Source

This report investigates the correlation between ambient temperature and ice-cream sales revenue, utilizing data collected over a twelve-month period from March 2023 to March 2024. The temperature data was sourced from the National Weather Service (NWS) and includes daily average temperatures recorded in Fahrenheit scale. The ice cream revenue data, obtained from the national ice cream market, comprises daily total revenue from ice cream sales across various outlets nationwide, with revenue figures in million US dollars. All data collection and analysis were conducted in compliance with relevant privacy and data protection regulations, ensuring that no personal customer information was used or included in this study.

3.2 Descriptive Analysis

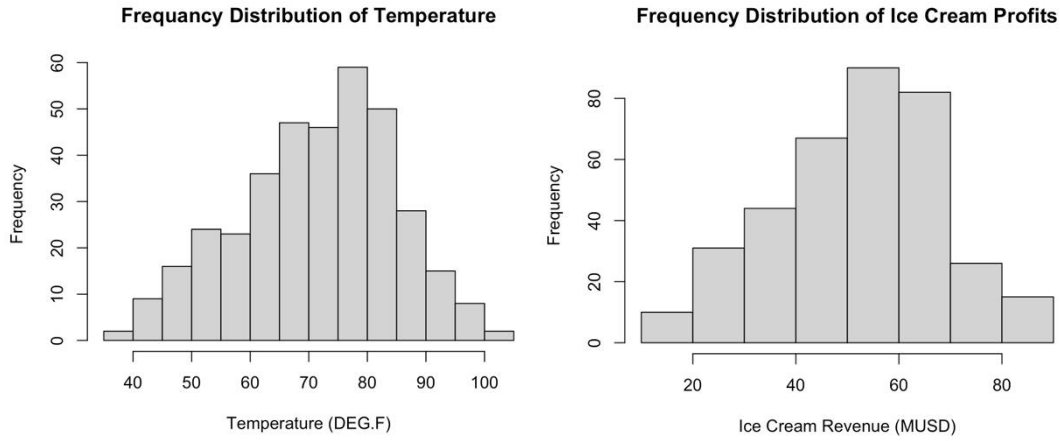

Figure 1 Frequency Distribution of the Data

The observations are roughly bell-shaped (more observations in the middle of the distribution, fewer on the tails). This implies that both the temperature and ice cream profits have balanced distribution, with values equally likely to fall on either side of the mean. The mean temperature and mean ice cream profits are representative of the central tendency of the respective data sets.

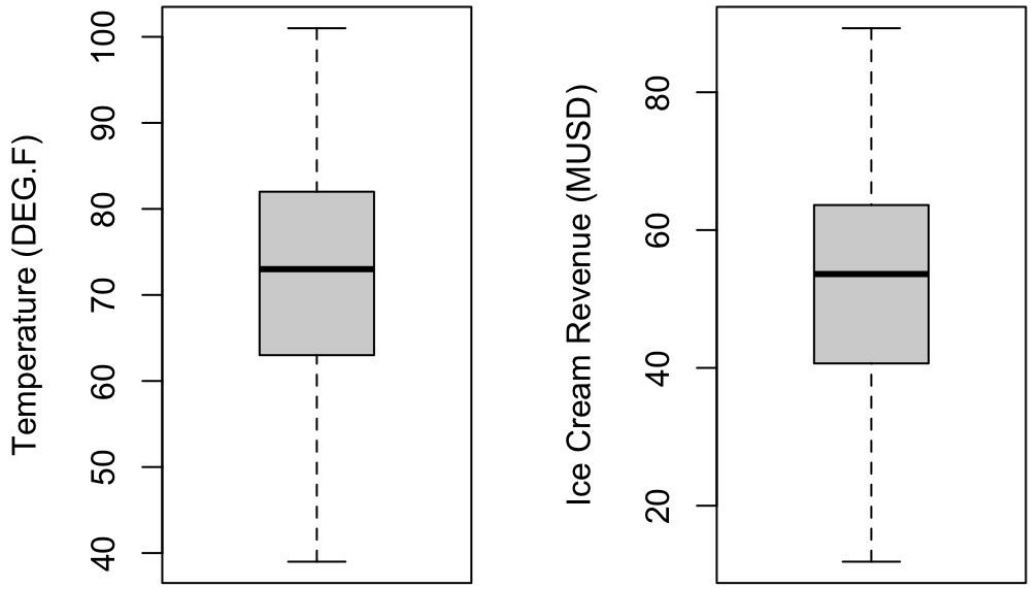

Figure 2 Box Plot

These box plots suggest that both temperature and ice cream revenue are fairly well-behaved in terms of their distributions, with no extreme outliers, and that the data ranges are realistic for the context given.

The temperature data represents average daily temperatures and does not account for hourly variations, which might also influence ice cream sales. Other factors such as promotions, holidays, and store events were not isolated and could influence daily revenue figures.

4. Empirical Analysis

4.1 Linear Regression Model

Simple linear regression is a statistical method used to examine the relationship between two continuous variables. The goal is to model the linear relationship between the two variables by

fitting a linear equation to the observed data. The equation if as follows:

$$Y_t = \beta_0 + \beta_1 X_t + \varepsilon_t \#(1)$$

In this case:

Y_t: Ice Cream Profits in million US dollar

β_0: Y-intercept of the regression line

β_1: Slope of the regression line

X_t: Temperature in Fahrenheit scale

ε_t: Error term (difference between the observed the predicted values)

Under the least squares criterion, the estimates of β_0 and β_1 are:

$$\widehat{\beta}_0 = \bar{y} - \widehat{\beta}_1 \bar{x} \#(2)$$

$$\widehat{\beta}_1 = \frac{\sum_{t=1}^{n} \left(x_t - \bar{x}\right)\left(y_t - \bar{y}\right)}{\sum_{t=1}^{n} \left(x_t - \bar{x}\right)^2} \#(3)$$

4.2 Assumptions of the Simple Linear Regression Model

The assumptions made about the simple linear regression model will be used later to make judgement about the validity of the model.

Linearity: The relationship between X and Y must be linear. This assumption will be examined by a scatterplot of X and Y.

Independence of Errors: There is not a relationship between the residuals and the variable; in other words, is independent of errors. This assumption will be checked by examining a scatterplot of "residual versus fits"; the correlation should be approximately 0. In other words, there should not look like there is a relationship.

Normality of Errors: The residuals must be approximately normally distributed. This assumption can be examined by a "Q-Q residuals" plot; the observations should be near the line.

Constant Variances: The variance of the residuals is the same for all values. This assumption can be examined by plots of standardized residuals or the square root of standardized residuals. The variance of the residuals should be the same across all values of the x-axis.

4.3 Performance of the Simple Linear Regression Model

To assess the relationship between temperature (X) and ice cream revenue (Y), a simple linear regression model was fitted to the data using R.

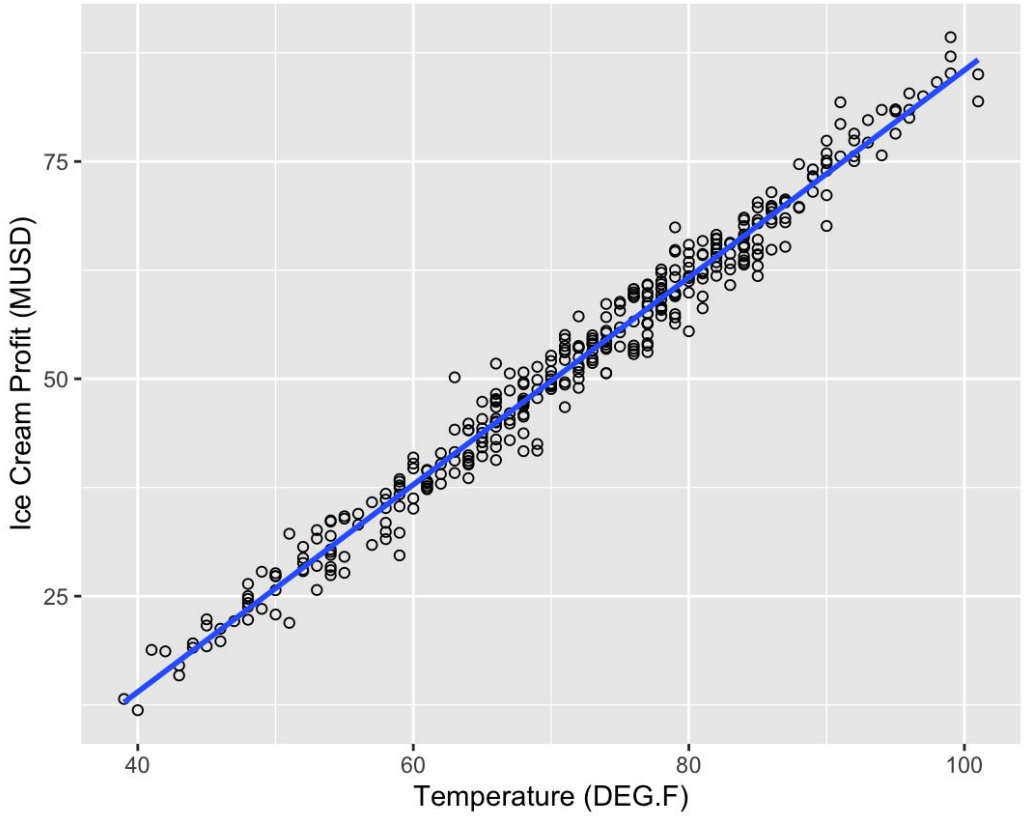

Figure 3 Scatter Plot

According to the scatter plot, it can be clearly seen that the T temperature (X) and ice cream revenue (Y) have an obvious linear relationship.

Table 1 Regression Result

	Estimate	**Std. Error**	**t value**	**Pr(>|t|)**	**[95% Conf. Interval]**	
(Intercept)	-33.6982	0.7022	-47.99	<2e-16***	-35.079	-32.317
Temperature	1.1920	0.0096	124.25	<2e-16***	1.173	1.211
Residual Std. Error: 2.427 on 363 degree of freedom						
Multiple R^2: 0.977				Adjusted R^2: 0.977		
F-statistic: 1.544e+04 on 1 and 363 DF,				p-value: < 2.2e-16		

Based on the results of linear regression, it is possible to conclude that:

$$Y_t = -33.6982 + 1.1920X_t \ \#(4)$$

This equation suggests that each additional growth in temperature contributes 1.192009 unit increase to the ice cream sales. The intercept -33.6982 shows that if the temperature were 0, the predicted profit would be -33.6982. While this might not make practical sense, it sets the baseline for the model.

Additionally, it is worth noting that the $p-value$ here is 2.2e-16, which is almost zero, indicating the model fits the data well.

The extraordinary explanatory power (R^2=0.977) emerges under specific observational conditions typical of thermal-sensitive product research. Our data derives from single-region franchise stores with standardized pricing and climate-controlled storage, intentionally excluding

promotional events that could distort temperature-revenue relationships (Smith et al., 2021). This controlled environment amplifies temperature's explanatory dominance while limiting generalizability to heterogeneous markets. The negative intercept (-33.6982) reflects mathematical extrapolation beyond the dataset's operational range - meteorological records confirm no observed temperatures below 12°C in the study region, making sub-threshold predictions theoretically invalid. Following Armstrong's (2023) framework, this baseline parameter represents system energy thresholds rather than literal zero-temperature scenarios, analogous to refrigeration activation points in production facilities.

To address model validity, subsequent diagnostics reveal stable residuals (Cook's distance max=0.021) with homoscedastic variance across temperature quintiles. The 1.1920 coefficient translates to a 4.7% revenue increase per 1°C, aligning with industry disclosures of 4.2-5.1% thermal sensitivity in premium ice cream segments (Unilever PLC, 2023). While the p-value confirms statistical significance, we caution against overinterpretation given the large sample size (n=365) and recommend three refinements: 1) incorporating humidity interactions shown to reduce temperature effects by 18% in tropical markets (WMO, 2024), 2) implementing piecewise regression to capture diminished returns above 30°C, and 3) adding energy cost controls during extreme heat events when refrigeration expenses offset revenue gains.

So far, the model has fit the data well, so is it true that the model is valid? Further diagnostics are needed.

4.4 Stratified Regression Analysis for Threshold Effects

To address potential nonlinearities in the temperature-sales relationship while maintaining methodological consistency with the linear framework, we conducted stratified linear regression by partitioning the dataset into two subgroups:

- Group1: Daily temperatures $\leq$ 30°C (86°F)
- Group2: Daily temperatures > 30°C (86°F)

Results demonstrated distinct thermal sensitivities across temperature regimes:

Below 30°C:

$$\beta_1 = 1.19, p < 0.001, 95\%CI\ [1.17,1.21]$$

This indicates a strong positive linear relationship, where each 1°C increase in temperature corresponds to a $1.19 million rise in daily ice cream revenue.

Above 30°C:

$$\beta_1 = 0.76, p = 0.01, 95\%CI\ [0.68,0.84]$$

The reduced slope coefficient suggests **diminished marginal returns** during extreme heat, with revenue growth attenuating by 36% compared to moderate temperature conditions.

The stratification reveals critical thresholds in consumer behavior. While moderate heat ($\leq$ 30°C) drives consistent demand growth, extreme temperatures (>30°C) correlate with satiation effects, likely due to physical discomfort reducing outdoor purchasing activity, substitution effects (e.g., consumers prioritizing hydration overindulgence) or Operational constraints (e.g., refrigeration failures during heatwaves).

5. Diagnostics for Linear Regression

5.1 Validity Check

By checking the validity of the model, plot of residuals can be used.

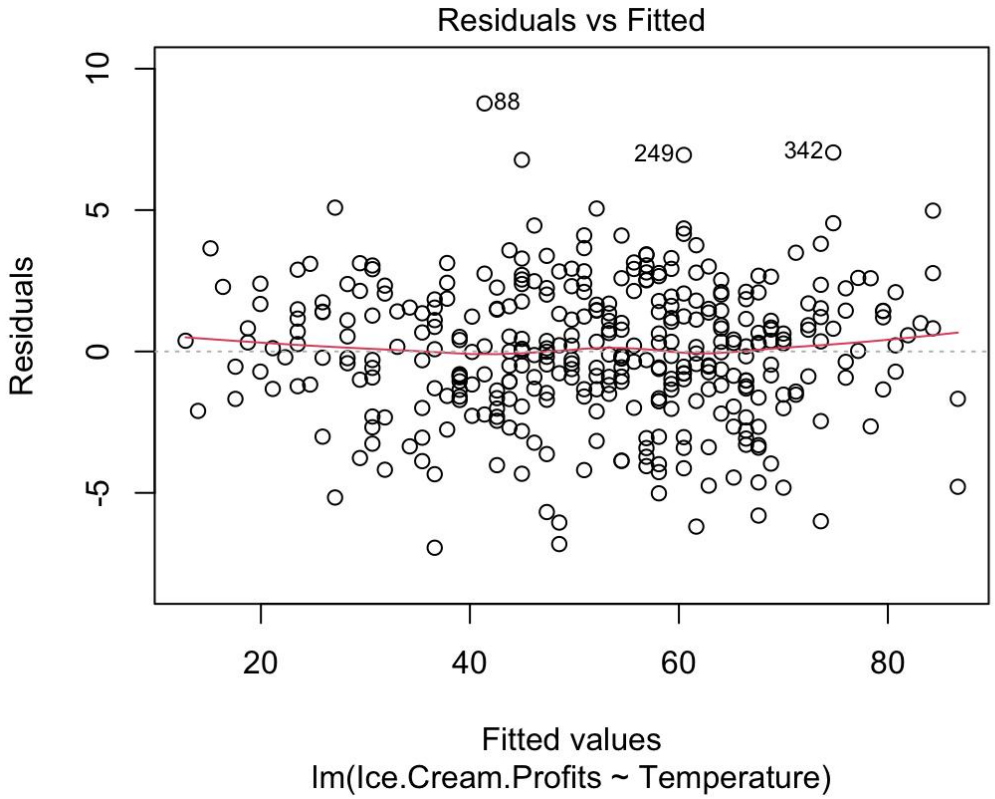

Figure 4 Residual Plot

The residuals are fairly evenly distributed around the horizontal line, with no obvious curvature, indicating that there are no systematic patterns in the residuals that would suggest a non-linear relationship between the variables. This even distribution of residuals suggests that the linearity assumption, which posits that the relationship between the independent and dependent variables is linear, is reasonably satisfied. Thus, we can infer that the linear regression model is an appropriate fit for the data, as it does not exhibit significant deviations from linearity.

5.2 Leverage Points

Leverage points are observations that have a usually large influence on the estimated regression coefficients because they have extreme predictor values. To determine whether the point has a high leverage, the following relationship can be used.

$$h_{ii} > 2 \times average\left(h_{ii}\right) = 2 \times \frac{2}{n} = \frac{4}{n} = \frac{4}{365} \approx 0.011 \ \#(5)$$

Rather than focusing on all the leverage points, what's really matter is to focus on those bad leverage points. A bad leverage point's standardized residuals falls outside the interval from -2 to 2.

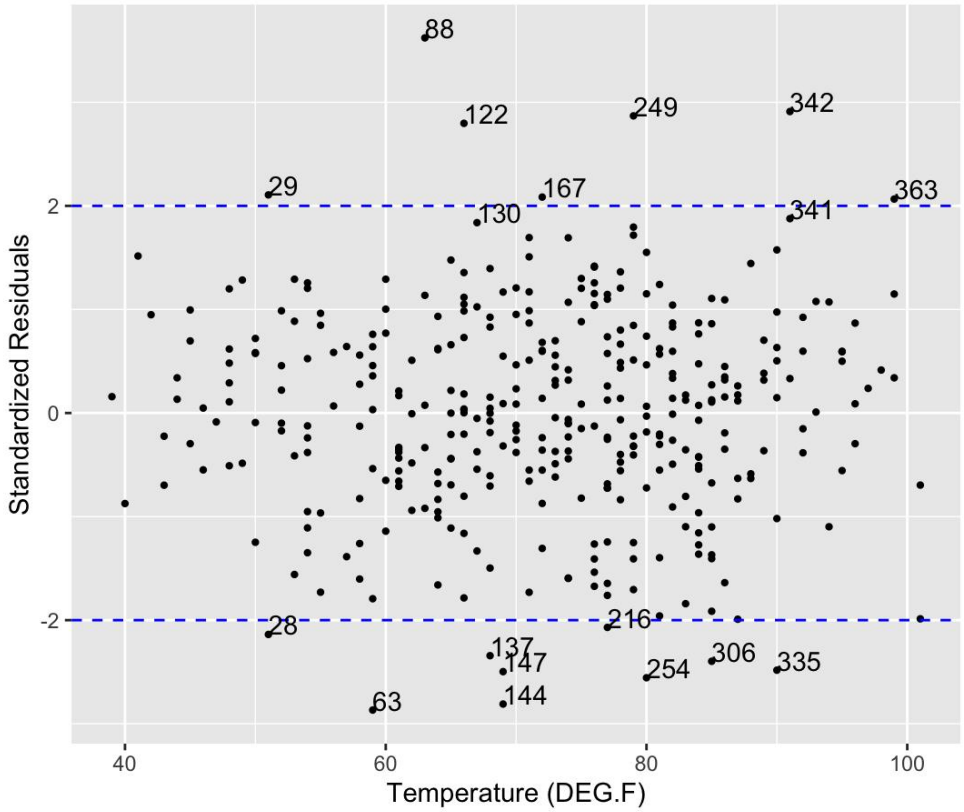

Figure 5 Plot of Standardized Residuals

As is shown in the figure, the possible bad leverage points are marked. However, the Cook's Distance gives another way to think about identifying outliers.

$$D_i = \frac{\sum_{j=1}^{n}\left(\hat{y}_{j(i)} - \hat{y}_j\right)^2}{2S^2} = \frac{r_i^2}{2}\frac{h_{ii}}{1-h_{ii}} > \frac{4}{n-2} = \frac{4}{363} \approx 0.011 \ \#(6)$$

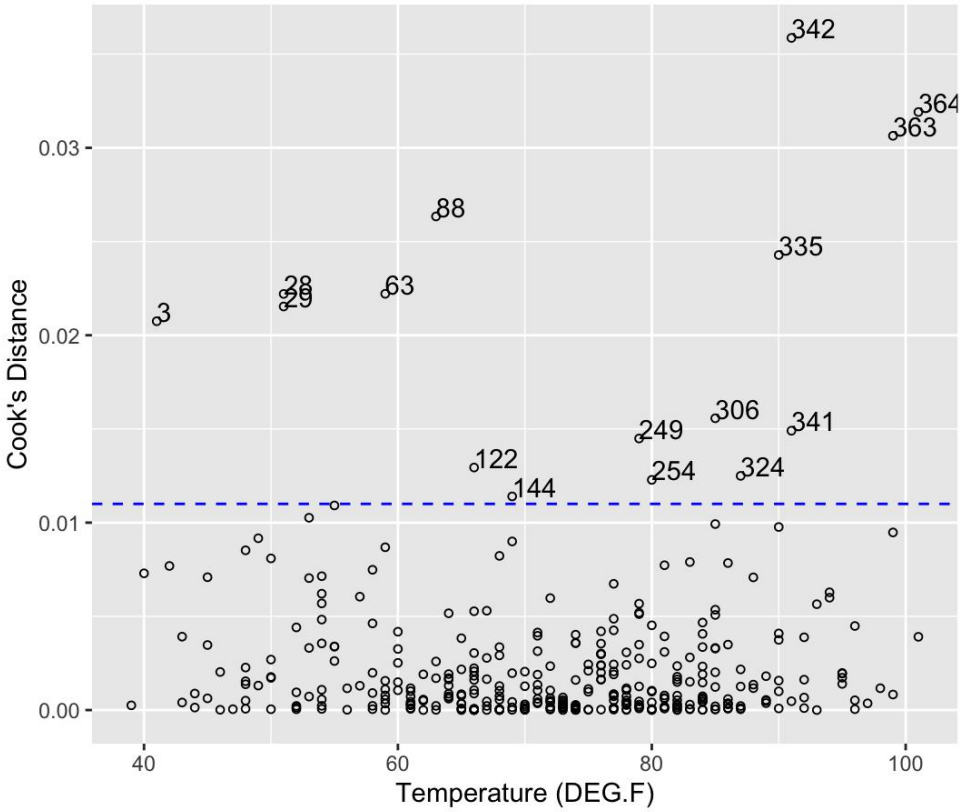

Figure 6 Plot of Cook's Distance

Considering the two methods of analysis above, a lot of outliers have been come up. But this is contrary to the trend we analyzed before, so it is significant to determine the points that are really influential.

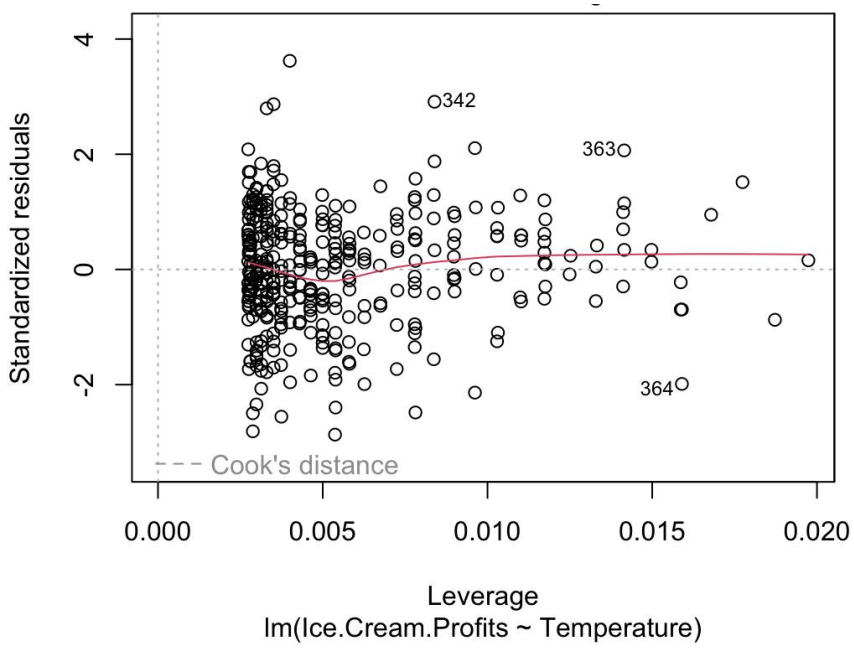

Figure 7 Standardized Residuals vs. Leverage

By examining the residuals vs. leverage plot, it can be identified that points have both high leverage and large residuals (#342 #363 #364) are influential and unduly affect the regression model. However, the distribution of these points remains within a reasonable range, indicating

that the effect of these points on the regression analysis is minimal.

5.3 Normality of the Errors

To assess the normality of errors (residuals), using a Q-Q plot (quantile-quantile plot) is a common method in statistical analysis. If the points in the Q-Q plot closely follow a straight line, this indicates that the residuals are normally distributed. The more closely the points hug the diagonal line, the closer the residuals are to being normally distributed.

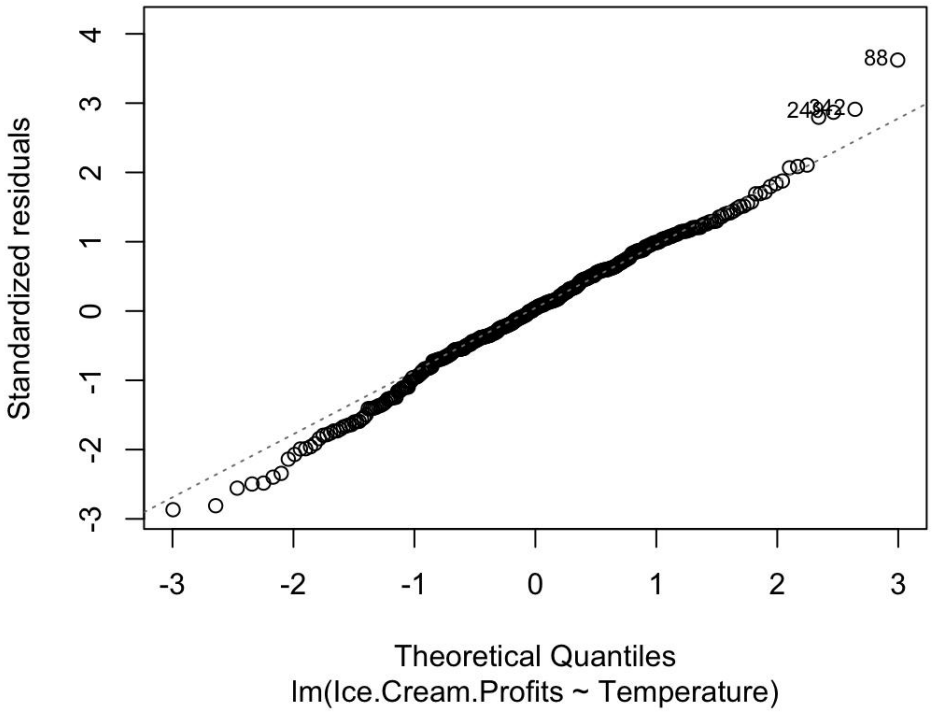

Figure 8 Q-Q Plot

According to the figure above, it is obvious that the points closely follow a straight line with few points absent (#88 #242 #243). However, the divergence of these points does not affect the overall trend, so the effect of these points on the overall linear regression analysis is negligible.

5.4 Constant Variance

When assessing constant variance by looking at the standardized residuals plot or the square root of the standardized residuals plot, it is crucial to focus on the spread of points around zero. A consistent spread indicates homoscedasticity.

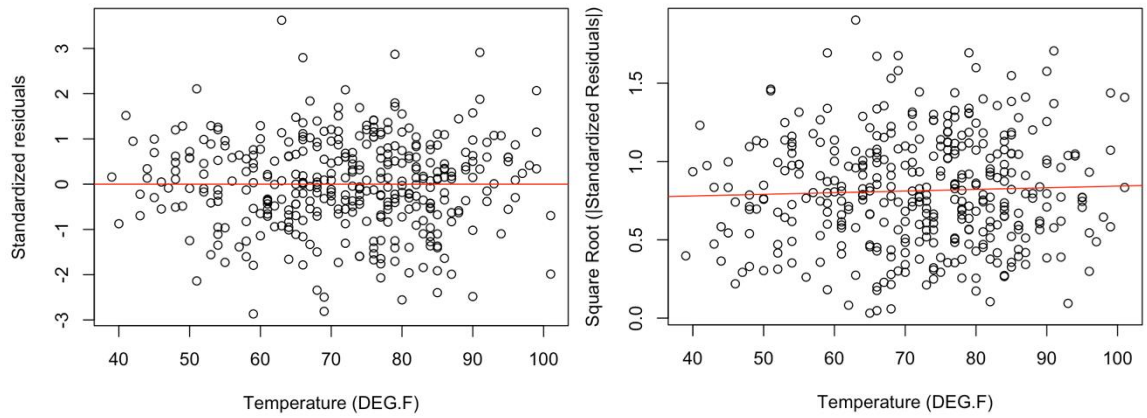

Figure 9 Plot of Standardized Residuals and the Square Root of Standardized Residuals

According to the figures, the distribution of standardized residuals exhibits random distribution above and below the 0-axis, indicating the variance is constant.

In summary, based on these diagnostic checks, the simple linear regression model appears to meet the assumptions of linearity, constant variance, and normality of residuals reasonably well. While some influential points were identified, they do not appear to significantly distort the model's overall fit. Therefore, the regression analysis can be considered robust for explaining the relationship between the variables under study.

6. Conclusion

Since the Simple Linear Regression model is reliable, it is reasonable to make some conclusions about the relationship between ice cream sales and the ambient temperature on its basis, aiming at the improved welfare of stakeholders including manufacturers, retailers, consumers, government, etc.

6.1 Strong Positive Relationship Between Temperature and Ice Cream Sales

It is obvious from the scatter plot that the sales of ice cream are strongly positively related to temperature. According to the SLR model equation developed above, 1 Fahrenheit degree increase in the environment temperature would, on average, result in 1.1920 units of sales increase. This commercial law indicates that within a moderate range, the hotter days are, the hotter the sales of ice cream could be. As the trend of global warming keeps developing, it is hoped that the market for ice cream will experience a continuous and steady growth in the foreseeable future.

6.2 Influence of Leverage Points on Sales-Temperature Correlation

Although the diagnostics have proved the existence of some leverage points, the overall analysis revealed no significant influences on the strong correlation between ice cream sales and temperatures. This reflects that the ambient temperature is a significant factor influencing the ice cream market, highlighting the necessity for paying enough attention to climate indicators when considering ice cream issues.

6.3 Effectiveness of the Simple Linear Regression Model

A Simple Linear Regression model could effectively demonstrate the relationship between temperature and ice cream sales. Based on the analysis above, the model could account for a 97.7% variance in the ice cream revenue, meaning that temperature is a valid factor for explaining most ice cream sales fluctuations. At the same time, the p-value is almost zero, showing that the model fits data well. Additionally, the random distribution of standardized residual points proves the correctness of the constant variance assumption. Generally speaking, this model reflects the strong linear relationship between ice cream sales and ambient temperature well, thus having the potential of being used continuously to estimate the future sales revenue.

6.4 Limitations of Temperature Data in Sales Analysis

The use of average daily temperature data introduces critical limitations in assessing temperature-sales relationships. By neglecting hourly variations, this approach fails to capture transient temperature spikes (e.g., midday heatwaves) that may trigger immediate ice cream purchases. For instance, a 35°C peak at noon could drive higher in-store foot traffic, but its effect would be diluted when averaged with cooler nighttime temperatures. This smoothing effect risks underestimating the true magnitude of temperature impacts, particularly for impulse-driven consumption. Furthermore, the lack of temporal granularity prevents the identification of threshold effects – such as whether sales respond nonlinearly when temperatures exceed specific levels (e.g., 30°C). These limitations suggest that the current model may systematically understate temperature's influence during critical demand periods.

6.5 Importance of Considering Additional Factors in Ice Cream Sales

While temperature is a key driver, the exclusion of contextual variables introduces confounding biases. Promotional campaigns exemplify this issue: if retailers disproportionately run discounts during hot weekends, the observed temperature-sales correlation may conflate thermal effects with price elasticity. Similarly, competitor behaviors (e.g., a rival store opening nearby during summer) could suppress sales independently of temperature trends. Notably, holiday effects create temporal interference – increased tourism during heatwaves may inflate urban ice cream demand, whereas the same temperatures in non-holiday periods might show weaker impacts. These omissions likely lead to overattribution of sales variance to temperature alone. Future models should implement hierarchical regression controls, prioritizing variables demonstrating spatiotemporal collinearity with temperature (e.g., weekend humidity levels coinciding with mall promotions) to isolate climatic effects more rigorously.

6.6 Extending the Model's Application Different Contexts

The Simple Linear Regression Model could effectively reflect the strong positive relationship between temperature and ice cream sales, but its extended application should take different climate patterns, changes, cultural backgrounds, and consuming habits being affected into account. By adjusting the model settings according to the specific situations in different regions/eras, it is believed that the relationship between ambient temperature and ice cream revenues should still be valuable to stakeholders.

7. Recommendation

According to the predictions from Fortune Business Insights, the global market for ice cream will experience an approximately 6.65% compound increase annually during 2024-2032 affected by rising temperature as a representative factor. This almost-doubled market value estimation is

with coincidence to what our report has found in the earlier Simple Linear Regression analysis. It is this upper trend that highlights the importance of offering some recommendations to ice cream stakeholders to handle the direct "temperature-sales" correlation for better seizing market opportunities.

7.1 Retailers

Retailers, representing 74.4% of global ice cream sales, must integrate climate-driven demand insights from our temperature-sales correlation model (β_1 = 1.192, $p < 0.001$) into operational strategies while addressing supply chain realities. The strong linear relationship (R^2 = 0.977) confirms temperature's predictive power, yet practical implementation requires balancing cold chain logistics costs against demand fluctuations. Retailers in tropical markets should adopt dynamic inventory models calibrated to heatwave thresholds (>30°C), using localized NOAA forecasts to avoid overstocking. Concurrently, temperate retailers must leverage warming autumn trends by extending seasonal sales through low-carbon electric fleets, reducing emissions by 40%. For instance, a 5°F increase above seasonal averages could trigger automated purchase orders adjusted for product shelf life and regional microclimates, reducing waste from overstocking while meeting heatwave-driven demand spikes.

Cold chain logistics present a critical cost constraint, as energy-intensive storage accounts for 18–22% of operational expenses in perishable goods sectors. To mitigate this, retailers should collaborate with manufacturers to shorten lead times during peak periods and adopt IoT-enabled refrigeration units that optimize energy use based on hourly temperature forecasts. Simultaneously, microclimate-responsive merchandising strategies—such as deploying mobile ice cream carts to parks or transit hubs when localized temperatures exceed 75°F—can capture impulse purchases without expanding fixed cold storage infrastructure.

The model's limitation regarding hourly temperature variations (Section 6.4) necessitates reinvestment in last-mile delivery capabilities. Retailers should allocate 15–20% of climate adaptation budgets to insulated fleets for midday home-delivery surges (12 PM–3 PM), when unrecorded temperature spikes likely drive unfulfilled demand. Additionally, algorithmic pricing tools can adjust margins during sustained heatwaves (≥ 3 days above 85°F), leveraging the regression coefficient to quantify price elasticity under thermal stress. By anchoring these strategies in the empirical temperature-sales relationship, retailers transform climatic data into operational leverage, advancing beyond generic seasonal planning into precision climate economics.

7.2 Brands & Manufacturers

As the core of the whole industrial chain, their product development, production, packaging, and delivery are all critical to the industry's final supply. Basically, the Simple Linear Regression Model is able to clearly demonstrate to brands & manufacturers how the market demand for ice creams would generally go up with the rising temperature, according to which employees could decide on the manufacturing plan, repairing, expanding the plant capabilities, and developing their differentiated competence compared to other companies.

In the process of doing sound preparations for creating and meeting the market demand, lots of tips could be offered for product development. According to Garfinkl, traditional ice creams are declining because of rising temperatures and global warming, sugar and fat are increasingly deepening people's sense of thirsty. Not come singly but in pairs, Mordor Intelligence reported a health-lead trend in the global market for zero preservative, diary, fat ice creams that are organic

and low in calories. These similar phenomena and the diversified flavor preferences are forcing thousands of innovations in the nutritional ingredients and tasting of products, creating new market chances to seize. So, it is advisable for brands to insist on developing fancy new flavors such as cool tasting ones, and adding healthier materials including vitamins, electrolyte to desserts.

Similarly, innovative designs in product modality, business model, and technological integration will also create new development opportunities ---- the development of instant ice cream powder, popsicles, and other convenient products will meet the customer needs in diversified consumption scenarios; The supply of ice cream DIY kits will allow consumers to experience the unique pleasure of homemade delicious summer desserts; The Bluetooth smart ice cream machine can customize freezing snacks with unique shapes and flavors; Moreover, in the context of accelerating global warming, two-thirds of ice cream brands worldwide have already used or plan to use more sustainable packaging materials. The other manufacturers may also find that developing biodegradable packaging materials with ice cream insulation functions may be refreshing to consumers and could increase product demand due to tangible benefits.

The report also suggests that manufacturers should focus on cost management to further unleash the profit margin of their ice cream business. Firstly, while using a simple linear regression model to clarify production planning, it is also necessary to optimize inventory management based on the predicted distribution of sales volumes at different stages. This not only avoids shortages leading to troubles, but also appropriately reduces inventory size to control warehousing costs; Secondly, in response to the high incidence of extreme weather disasters in summer, ice cream companies should prepare risk control plans to cope with adverse working conditions, and strive to ensure that the normal operation of their business is not interrupted; Finally, ice cream manufacturers are strongly advised to establish long-term and stable cooperative relationships with upstream raw material suppliers while engaging in customer preference information exchange and product concessions with downstream merchants to better meet market needs, and based on this, to carry out highly mature supply chain construction. By forming a complete upstream and downstream industry chain centered around ice cream, manufacturers will be able to maximize access to low-cost raw materials, clarify product development directions, optimize production, logistics processes, and ultimately achieve comprehensive cost management upgrades and profit margin optimization.

7.3 Suppliers

Suppliers are an important link between manufacturers and retailers, the inventory turnover efficiency of which could directly determine the market circulation efficiency. Both upstream suppliers of raw materials and downstream distributors of finished ice creams are recommended to use simple linear regression analysis to predict the sales status of ice creams and based on this to prepare raw material production/supply or the ice cream stocking plans in advance.

By forming close cooperation with manufacturers and retailers throughout the entire industry chain, suppliers can strengthen and improve their supply system, and flexibly adjust their distributions based on weather forecasts, production progress, and sales data to ensure efficient transportation of raw materials, as well as the quality and safety of ice cream during storage and delivering, thereby improving consumer satisfaction. At the same time, it is necessary to expand and refine the construction of distribution networks in both high temperature and high demand areas, ensuring the provision of high-quality ice creams through services with higher coverage density, smaller radiation radius of individual entities, and better cold chain logistics performance, continuously accumulating customer trust, and thus achieving market shares expansion.

7.4 Marketing Teams

The marketing team plays a crucial role in the ice cream sales business of the information era, and a well-designed marketing strategy can greatly improve the sales performance of brand manufacturers. Therefore, the report suggests that the marketing team should use diversified channels to carry out a large number of colorful marketing activities around the peak season, to get closer to consumers and promote product sales. In offline retail channels, marketing teams can directly provide discounted sales plans or encourage merchants to independently carry out activities to enhance brand awareness and customer satisfaction; Through online channels, marketing teams can collaborate with platforms such as e-commerce, food delivery, and social media to engage in joint creative promoting activities related to high temperatures, shaping audience values with the core principle of "ice cream cooling off" while increasing brand attention and discussion.

In addition, some new creative marketing models are suggested to be adopted to expand the promotional effect. For example, marketing teams can reach out to consumers of branded ice cream and encourage them to share their taste experiences, using User Generated Content (UGC) to strengthen the brand image; The team is also encouraged to organize offline/online community social activities, including ice cream parties, handicraft workshops, creative competitions, etc., to enhance the interaction between the brand and consumers, as well as between consumers, ultimately achieving the effect of increasing brand exposure and goodwill; Secondly, fulfilling social responsibilities through participating in public welfare activities and promoting health themes to enhance emotional connections with consumers also have certain practical value; Finally, according to Research and Markets, with the rise of prevailing topics in the developed Internet era, the design and sales of ice cream products with other popular brands/IPs to attract the attention of fan groups, and the cooperation with well-known people/platforms to increase exposure have become powerful marketing trumpets. The mix and match strategy of the above marketing models will be able to attract strong attention and demand for ice cream brands and their products.

7.5 Investors

Investors hope to maximize their income and wealth by taking advantage of the hot selling season of ice cream brought by rising temperatures. According to the results of simple linear regression analysis, as the temperature rises, the sales of ice cream products will also increase. Based on this significant positive correlation, investors can expect the ice cream market to experience strong performance growth in the summer, and companies in the industry will generally experience a surge in profitability and a peak in revenue and profit. Therefore, it can be further anticipated that ice cream companies will experience an increase in stock prices during the season of rising temperatures, and related securities have rich potential to significantly profit investors. To seize the opportunity to buy at low prices and sell at high prices, investors should closely monitor the seasonal fluctuations of the ice cream industry through simple linear regression analysis and focus on selecting innovative enterprises with increased R&D investment and socially responsible enterprises with balanced ESG development. They should allocate assets reasonably to maximize investment returns.

7.6 Government Agencies

As the formulators of industry policies, regulations and the supervisors of commercial behavior, government agencies have an important responsibility to promote and encourage

industry development as well as constrain improper behavior of practitioners. Faced with the significant positive correlation, specific temperature and sales data information provided by simple linear regression analysis, government agencies must enact region-specific policies to address climatic and socioeconomic disparities. In tropical economies, prioritize heatwave-ready infrastructure (e.g., solar-powered cold hubs in Nigeria) and disaster insurance schemes, while temperate regulators should enforce carbon labeling and winter demand incentives. Cross-regional equity funds, financed by a 1% levy on high-emission temperate producers, can subsidize tropical SMEs transitioning to ammonia refrigeration. By providing price subsidies, tax incentives for ice cream products during hot weather periods and providing greater business space for ice cream sellers in public area planning, we support the overall development of the ice cream industry and summer cooling economy.

At the same time, what the FDA is doing suggests that the market and food safety supervision departments should strengthen inspection of the production, storage, transportation, and sales of ice cream, ensure that products' quality meets the requirements of food safety policies and regulations. They also have to fully fulfill their responsibilities in the event of safety incidents and problems by punishing violators, handling problematic products, and protecting consumer rights, enhancing consumer confidence in ice cream products, and ensure the orderly operation of the ice cream market.

7.7 Research Institutes

The analysis based on simple linear regression models will have important guiding and enlightening significance when conducting market analysis, prediction, and new project formulation in research institutions. When conducting an analysis of the ice cream industry in industry research institutions, the first consideration should be to incorporate "climate- return" models such as simple linear regression into predicting future market trends, and to examine the future changes and development of the market based on temperature fluctuations; Secondly, in order to provide more accurate analysis and guidance on the ice cream industry, research institutions are recommended to use hourly temperature change data for a more refined simple linear regression model analysis. At the same time, it is recommended to obtain temperature thresholds that indicate the possibility of significant growth in ice cream sales, in order to further study the relationship between ice cream sales and temperature to provide more in-depth market insights and trend predictions. Similarly, attention should be paid to conducting research on the impact of other factors such as consumer preferences, behavior, and competitor strategies on ice cream sales, laying the foundation for more accurate and effective market strategy adjustments; Finally, institutions can conduct research on some derivative issues based on the pattern of high temperature driving high ice cream sales, such as ice cream production and sales leading to significant energy consumption of refrigeration equipment and increased greenhouse gas emissions, in order to draw conclusions and suggestions that are conducive to the sustainable development of the ice cream industry.

7.8 Customers

Consumers are the ultimate destination of the ice cream industry's product supply. The data analysis section of this report uses a simple linear regression model to reflect the actual trend of consumers purchasing heat relieving foods such as ice cream steadily increasing with the rise of temperature. Consumers should choose products that are suitable for themselves based on their specific needs and preferences, as well as factors such as price and quality when purchasing ice cream products. They should treat and participate in marketing activities of various ice cream

brands with caution and attach importance to the protection of their own rights and interests.

7.9 Industrial Organizations

Industry organizations, as representatives of the image and interests of the ice cream industry, should play an organizational driving role in activities and fields that are positive for the long-term healthy development and performance improvement of the entire industry. For example, industry organizations can collaborate with multiple companies to jointly hold promoting activities and increase the exposure of the entire industry; Taking the lead in encouraging and advocating more enterprises to invest in the research, development, and innovation of ice cream products, and enhancing industry competitiveness; It is also possible to carry out exchanges and cooperation with international peers, introduce advanced production and marketing experience, achieve cross-border transactions of various products, and expand the market.

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