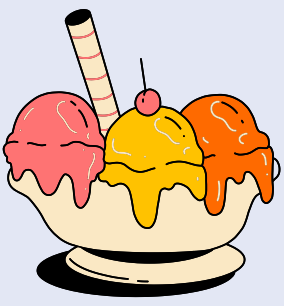
# Weather's Effect on Ice Kitchen and Competitors' Sales

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We analyzed the sales of 97 businesses in the United Kingdom, focusing on an ice lolly business called Ice Kitchen. Using normalized slopes and $R^2$ scores of sales versus temperature with thresholds of 0.03 and 0.4 respectively, we found strong relationships for 18 businesses to determine at what temperature a business starts seeing a reliable slope of sales versus temperature. The slope of Ice Kitchen sales crossed its threshold at 17°C and the $R^2$ scores crossed its at 15°C.


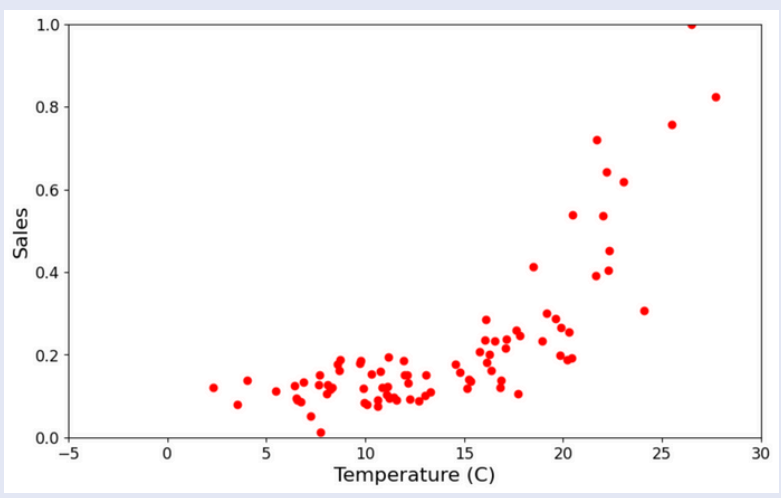


**Fig. 1.** Sales per week versus temperature in Celsius for **Ice Kitchen**. Sales data is weekly and is normalized (each data point is divided by the dataset's maximum value).

- The sales data in Figure 1 begins to **rise at 15°C** and on average increases thereafter.
- The slopes in Figure 2 go **above the threshold at 17°C**, meaning the slopes of sales versus temperature **become reliably high at 17°C**.
- The $R^2$ scores in Figure 2 **cross the threshold at 15°C**, meaning the slopes are **reasonably reliable after 15°C**.

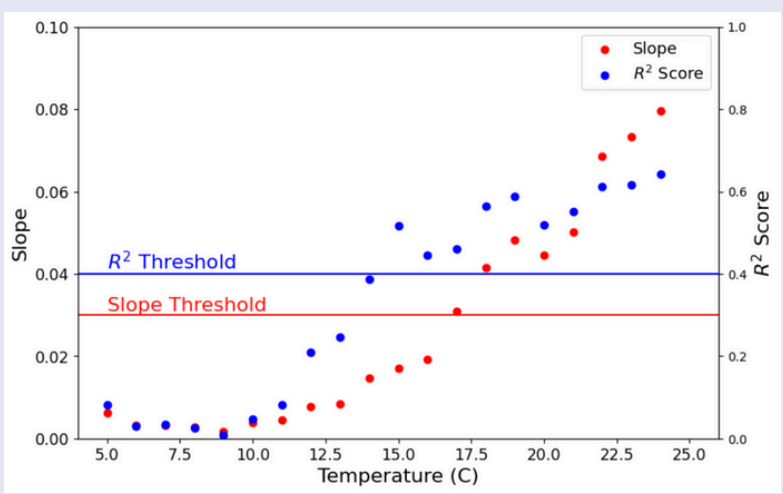


**Fig. 2.** Slope of sales per week versus temperature in Celsius for **Ice Kitchen**. The slope is found through a Linear Regression model trained at 10°C intervals. Each data point's x-coordinate is the center of the 10°C interval, and the y-axis is the model output's slope. The second y-axis is the corresponding $R^2$ score of the model's outputs.

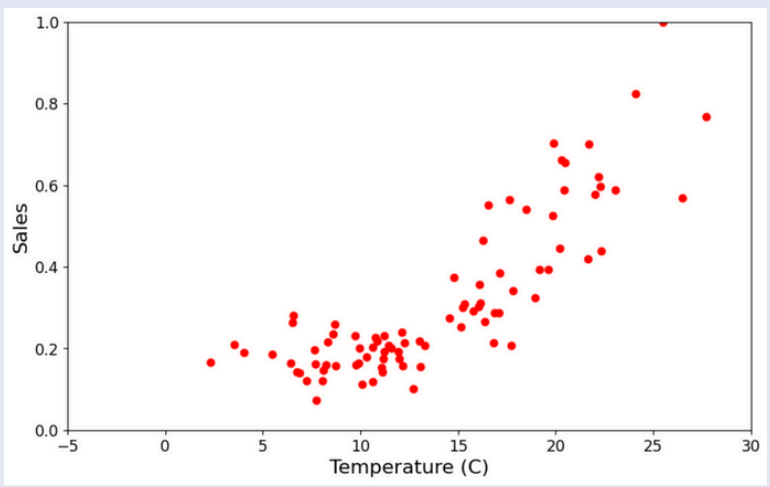


**Fig. 3.** Sales per week versus temperature in Celsius for **Rowntree's**. Sales data is weekly and is normalized, with each data point being divided by the dataset's maximum.

I attempted to replicate this work on other business sales data and began to see interesting patterns.

- Rowntree's demonstrates a **noticeable increase in sales after ~15°C** and steadily climbs thereafter in Figure 3.
- The slope of Rowntree's sales **crosses the threshold at 15°C**, while the $R^2$ scores **pass the threshold at 12°C** in Figure 4.

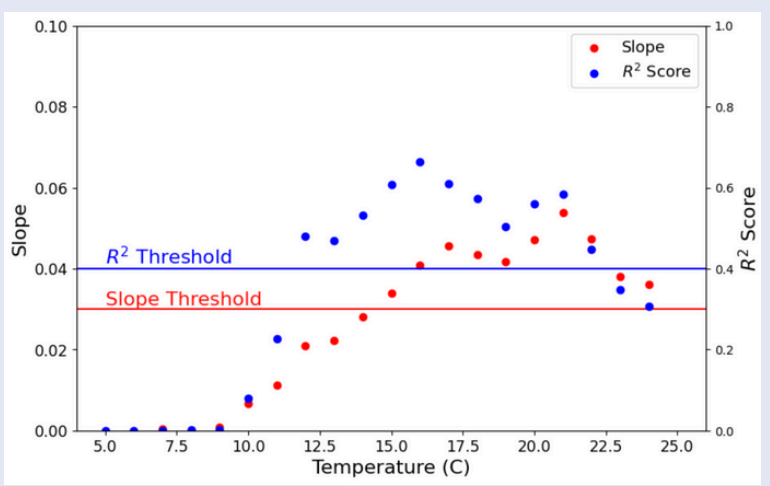


**Fig. 4.** Slope of sales per week versus temperature in Celsius for **Rowntree's**. The slope is found through a Linear Regression model trained at 10°C intervals. Each data point's x-coordinate is the center of the 10°C interval, and the y-axis is the model output's slope. The second y-axis is the corresponding $R^2$ score of the model's outputs.

**Table 1**

The temperature values at which the slopes and $R^2$ scores of a business's sales cross their respective thresholds (0.03 and 0.4)

| Business | Reliable Slope At | Reliable $R^2$ At |
|---|---|---|
| The Coconut Collab | 12°C | 14°C |
| Nestlé | 14°C | 14°C |
| Rowntree's | 15°C | 12°C |
| R. White's | 14°C | 14°C |
| Jude's | 15°C | 16°C |
| Pip Organic | 14°C | 12°C |
| Yoomoo | 14°C | 14°C |
| Remeo | 16°C | 15°C |
| Ice Kitchen | 17°C | 15°C |
| LICKALIX | 17°C | 15°C |
| Nuii | 16°C | 16°C |
| Magnum | 14°C | 12°C |
| Cornetto | 15°C | 12°C |
| Wall's | 15°C | 16°C |
| The Ice Co | 16°C | 20°C |
| Smooze | 19°C | 21°C |
| Del Monte | 21°C | 12°C |
| Northern Bloc | 17°C | 21°C |

## Summary

Seeing that sales data with a threshold-crossing slope but a low $R^2$ score or threshold-crossing $R^2$ score and a low slope both **do not suggest a reliable slope of sales vs temperature**, we can conclude that the temperature value at which a business begins having reliable slopes is only when both **the slope and $R^2$ score thresholds are crossed**. Thus, **it is 17°C at which Ice Kitchen begins seeing a reliably high slope of sales versus temperature.**