Rotman

RSM-8423 – Optimizing Supply Chain Management and Logistics

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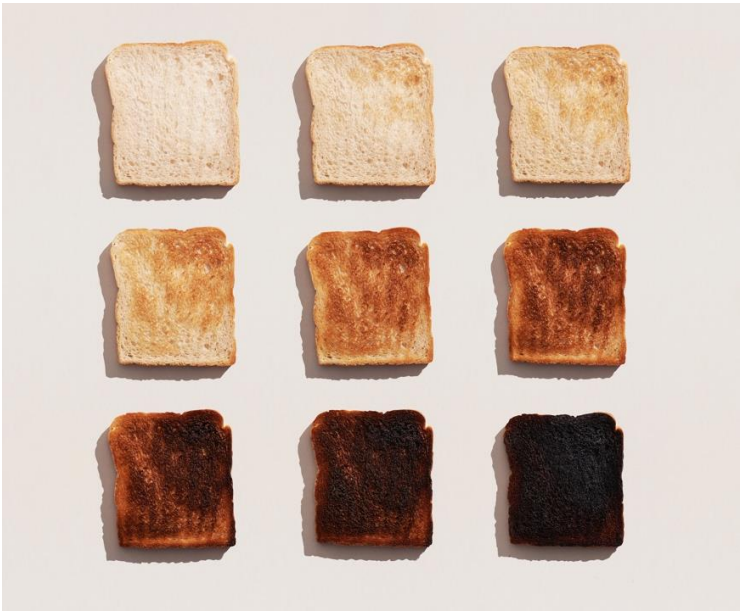
The Athers Controversy

A Case Study in the Food & Beverage Industry



Introduction

"I will not change my ways, you all tricksters!"

… announced Roger Athers, CEO and founder of *Athers Food Inc.,* during an investment call to discuss the operational challenges that the business faces due to COVID-19 and supply chain issues. Rogers has been leading the company for thirty years, turning it into a reference in shelf-stable foods such as canned goods and other long-term preserving items. The company, however, had suffered losses in profits during the last few years, even if revenues have been going up due to the increase in demand.

The heated debate occurred when Samantha Lyson, new Chief Operating Officer, attributed the issue to the current purchasing and selling systems, stating that they were not appropriate for the new industry realities. Specifically, their inventory policies were outdated and did not consider changes in demand and disruptions, especially ignoring spikes due to the pandemic or even annual trends.

Roger disagreed. He indicated that the firm had always maintained a large stock and it was ready for unexpected events, stating proudly that the company did not experience a stockout in these last five years. They also had large warehouses, so space was not an issue. Furthermore, he had a long-term and stable contract with his supplier, who was particularly trustworthy since he was his high-school friend.

After hours of discussion, the investment board asked Samantha to hire a third-party consultant to shed light into this issue. Samantha contracted you, as one of the best data analyst experts due to your MMA background, to help her evaluate the current inventory policies and propose alternatives, if possible.

However, this will not be an easy task. Roger has played an adversarial role and did not disclose important information about their current policies, only sharing minimal data for the analysis.

Data

Samantha wants to focus on the company most popular product, a healthy canned protein, which accounts for more than **80**% of their sales.

The company has shared product data for the three years preceding 2022 (i.e., 2019, 2020, and 2021). Each row in the dataset contains a **date** and the **product inventory level** at the end of that day. The inventory at the beginning of the day on January 1st, 2019 (not included in the data) was **5,000** units.

Production occurs in batches due to the complex food manufacturing process, which includes setup costs (e.g., decontamination) and raw material procurement. The batch process costs $**1,200** to set up, plus $**1.50** per unit produced. Further, the batch takes **nine** days to complete because most of the raw material must be imported and inspected by customs. Batches are requested by the end of the day and the process starts immediately. The production arrives early in the morning on the ninth day. For example, if a batch is requested at the end of day on March 20th, it arrives early in the morning on March 29th.

The products are stored on temperature-controlled shelves that must be dusted and cleaned regularly, incurring a cost of $**0.25**/unit per day. Each unit is sold at a high margin of $**35.50** to retailers.

Demand

The demand is handled by the marketing team at the company, which is led by Roger's wife. Alleging privacy concerns, they can only share limited information with Samantha and your team.

Based on what they shared, the daily demand increases by **70** units, on average, during the holiday season (November and December), as retailers add the product to gift baskets and bundles.

Moreover, since 2020, the daily demand increases by **10** units per year, on average, in comparison to the daily demand of the previous year in the same period. This is because of new contracts established by Athers Food with distributors such as Walmart, which begin on the first day of the year. The marketing team revealed that the number of new contracted distributors is artificially limited to prevent a large increase in demand, but that requests from retailers have skyrocketed since the pandemic started.

Finally, except for these two average increases, the marketing team has found that the demand has a very traditional distribution in the industry. Specifically, the daily demand follows a **negative binomial** that counts the **probability of 5 successes** (i.e., purchases) assuming a **purchase probability of 2%**. This is the **base demand**. That is, the daily demand is given on the basis of demand plus the increases due to the holiday season or new yearly contracts. This is a simple but often effective forecasting model in supply chains, serving as the building block of more complex models.

Your mission

To help you design this report, Samantha outlined some guiding managerial questions that you must address when constructing your narrative. They are as follows:

1. What is the demand pattern(s) that you identified?
2. What is the current inventory policy that the company implements?
3. Is the current inventory policy sustainable? That is, what would happen in terms of expected profits and costs in the next year (assume 2022 for simplicity) if the company continued implementing it, assuming demand trends remain the same?
4. Samantha heard about the EOQ model, which she found attractive since it is an easy policy to implement. What would be the differences in profit and costs if the firm had implemented the EOQ policy in previous years (2019-2021)? Make sure that you outline how profits/costs are changing per year. Are they better than the current policy? What are the trade-offs?
5. Analogously to (4), what would be the expected profit and costs in 2022 with an EOQ policy?
6. Samantha is focused on creating resilient supply chains, but she is also concerned about trade-offs. For your analysis of (4) and (5), evaluate the profits and costs for different levels of stockout risks. It is often very persuasive to build a plot "risk vs. profit" and "risk vs. cost," for example.
7. **(Bonus)** Suppose we want a more flexible model, where we can order any quantity that we wish in any moment in time. Propose a new model based on this flexibility.

For all questions above, assume the costs and parameters will remain the same in the future. You are also free to make additional assumptions, as long as they are reasonable and appropriately justified. Feel free to reach out if you have any questions about the system.

Deliverables

The deliverable for this case study are:

- The source code in **Python** with your analysis. The code must be clearly organized so that we can replicate your results exactly.

Evaluation

Your report will be given a raw score out of 100 points using the following scheme:

- ***Models*** [30 points]: If the inventory models you designed are sound and adequate to the problem.
- ***Analysis*** [30 points]: if the analysis is sound and comprehensive, addressing the questions posed by the agency.
- ***Implementation*** [30 points]: If the implementation of your models is correct and free of errors or bugs. It must also be well organized and readable.
- ***Writing*** [10 points]: if the report is well-written and organized.