Using survival analysis to determine optimal price ranges

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Introduction

Determining the optimal price for a product or a service is strategic information for validating its perceived value. It is also interesting to know whether a product has a higher projected value for a target compared to another one, or compared to another product, or not, in addition to hedonic judgments.

Some existing direct questioning methods are traditionally used, although with some limitations:

- Van Westendorp's Price Sensitivity (PSM) method: hard to answer for a consumer, with some inconsistencies between results from the four questions targeted.
- Willingness To Pay (WTP): consumers tend to exaggerate their answers
- Gabor Granger method: auction system, exaggerations
- For all methods: when modelling, hard to differentiate several products

Objectives

Development of **a hybrid methodology**

- Simplify PSM method to make it easier for consumers to answer, but to still obtain price ranges
- Determine whether a price is statistically different between two products/targets through modelling

Method

Optimal price range determined by **Survival Analysis** (can be sometimes used in consumers science [1;2]), using a Kaplan Meier method [3] and binomial law [4] . Statistical differences calculated through the **log rank method**.

Two questions on price for consumers with positive purchase intents:

- Minimum price that does not raise doubts about the quality of the product
- Maximum price they would be willing to pay for the product

Consumers exposed to fictitious shelves of fully branded products from the universe to **contextualize price.**

Materials

Two products evaluated on a fully branded online survey (average of 10 minutes to answer full survey):

- Roasted chicken
- Nitrite-free chicken

327 French consumers, buyers of this product category and responsible for food purchase for their household were surveyed. Images of products were available to help consumers respond, as well as fictitious shelves with four products from the category with prices indicated.

R was used for data analysis [5].

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References:
[1] Chambault, M. (2019). Sugar reduction: how low can we go? A novel application of Survival Analysis. *Pangborn 2019, Edinburgh (Scotland).*
[2] Allain, H. (2020). Optimum sugar reduction definition in carbonated soft drinks and influence of the labelling, using survival analysis. *EuroSense 2020, Rotterdam (the Netherlands).*
[3] Kaplan, E.; and Meier, P (1958). Nonparametric Estimation from Incomplete Observations. *Journal of the American Statistical Association* (1958) 53, 457-481.
[4] Ennis, J.M.; Ennis, D.M (2012). Justifying count-based comparisons. *Journal of sensory studies* 27 130-136.
[5] Survival analysis on R http://www.sthda.com/english/wiki/survival-analysis-basics

Results: Optimal price range **is different between products**

Minimum price

No differences between products: Pvalue=0.24. Minimum price is consequently studied accumulating products.

Optimum minimal price is at 1.15€ (Figure 1): most consumers do not doubt the quality of the product at this price.

Maximum price

Differences between products: Pvalue=0.01. Maximum price is consequently studied separating products.

Optimum maximum price is at 2.50€ for Roasted product and 2.70€ for Nitrite free product (Figure 2): most consumers accept products below these prices.

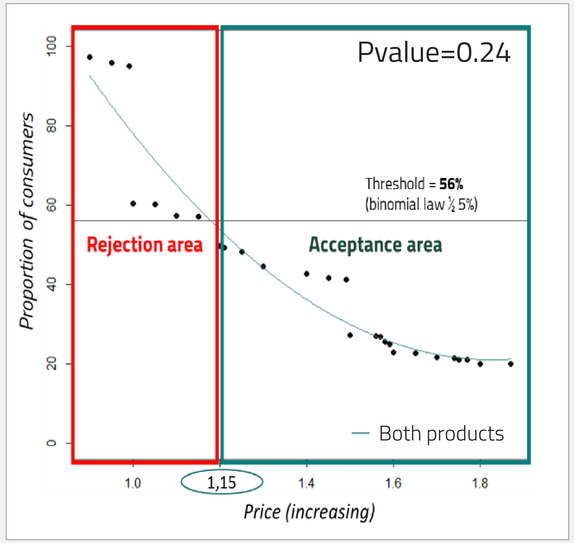

Figure 1: Modelling of survival results for minimum price. Roasted and nitrite-free products are accumulated.

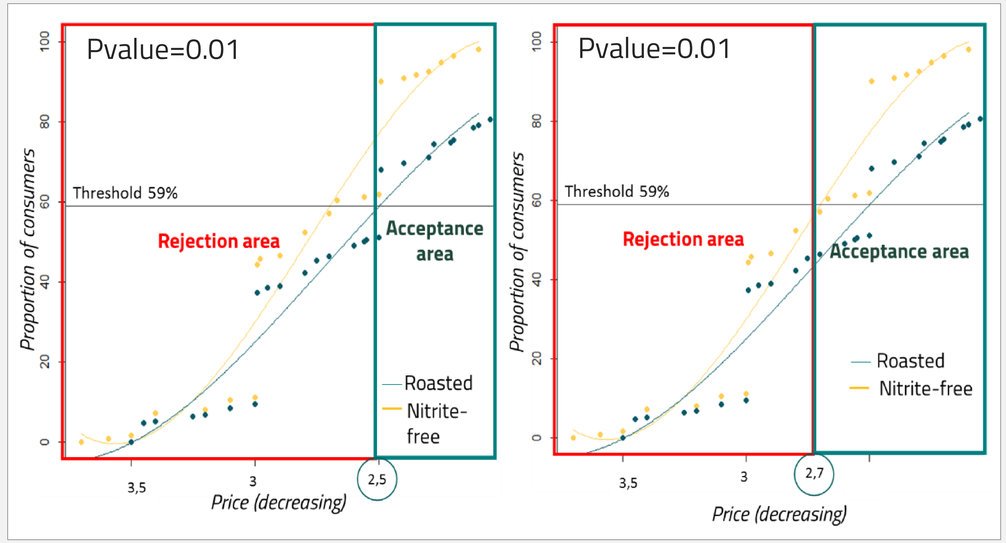

Figure 2: Modelling of survival results for maximum price. Left graph is for Roasted product and right pour Nitrite-free product.

- The projected maximum price is different for each product, with a **20 cents difference** and minimum price is identical for both products.
- For the nitrite-free reference, therefore, the willingness to pay is significantly higher, and the **ideal price range is greater**.

→ Using **Survival analysis** in this study allowed **price acceptance to be modeled** and **products to be statistically differentiated** according to this modeling.

Even if the price difference seems small, the potential consumers (= positive purchase intentions) were **willing to pay more** than for the other = better potential for the Nitrite free product.

Conclusion

The use of survival analysis is interesting in regard to price to **obtain another vision of products / packs / concepts differences** but also to model expectations instead of only considering a fixed price. **Modeling can be statistically studied** with this approach to determine whether some products, concepts or targets have a better forecast than others. It can also be useful to measure the impact of a new pack, a claim etc.

Survival analysis is also a useful tool to determine a precise threshold when developing products: it allows the impact on consumers' acceptance of the variation of some parameters (color intensity, amount of sugar/salt, etc.) to be modeled.