

PRICE ELASTICITIES FOR PACKAGED GOODS

OPTIMAL POST-PROCESSING FOR NOISY MODEL ESTIMATES.

CASE STUDY

Elder Research worked with a global food and beverage producer to optimize their price elasticity modeling framework, focusing on the pipeline component responsible for controlling noise in elasticity estimates. This component worked too well; it had the unintended effect of smoothing over real signal in the sensitivities. So Elder Research was tasked to develop a practical, productive replacement. Our solution also tames noisy model estimates but can dynamically choose the amount of smoothing applied.

THE CHALLENGE

This food and beverage client's pricing team maintains a multi-step demand-modeling framework that includes price-elasticity estimation. However, elasticity estimates from data can contain significant noise. So the client's framework includes a post-processing component that compresses, or regularizes, the modeled elasticities. This step tames poorly estimated or otherwise unreasonable sensitivities. But at times it compresses these values too much, smoothing over important details of how demand follows pricing changes.

The client asked Elder Research to take the lead in revising this component of their pricing model, identifying the optimal amount of compression needed to stabilize sensitivity estimates while preserving details of the price-demand interplay across the product-retailer landscape.

THE SOLUTION

Building on the client's original methods, Elder Research developed a revised, pragmatic approach to elasticity post-processing that intelligently determines:

- 1 when adjustments are required and,
- 2 if needed, how much compression ought to be applied.

The relative strength of any adjustment is captured by a single parameter, which also allows this revised methodology to serve as a model diagnostic. Elder Research provided the client with both R and Python implementations of the new approach, each capable of installation into the client's existing Azure Databricks-powered workflows.

INDUSTRY

Food and Beverage Manufacturing

BUSINESS NEED

The client sought improvements to price elasticity modeling workflows. They wanted to preserve the best aspects of existing work while identifying and refining the model estimates most likely impacted by noise or poor model fits.

SOLUTION

Elder Research developed a pragmatic approach that intelligently corrects elasticity estimates depending on whether they meet certain business criteria. This approach avoids adjusting model estimates unnecessarily. It also explains any adjustments in an understandable way.

The approach provided new views into the client's existing model framework, applying theoretical understanding to visualize detailed pricing impacts.

BENEFIT

This work resulted in new post-processing algorithms that were implemented in R and Python and developed to fit the client's existing Azure Databricks workflows.

The project also led to novel visualizations, for both business stakeholders and data scientists, that the client's data science teams aim to build on to better support business users.

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THE SOLUTION (continued)

This effort was driven by business stakeholders, so clear translations between theory and practice were crucial—first for demonstrating our approach and then for incorporating stakeholder ideas into the analytics.

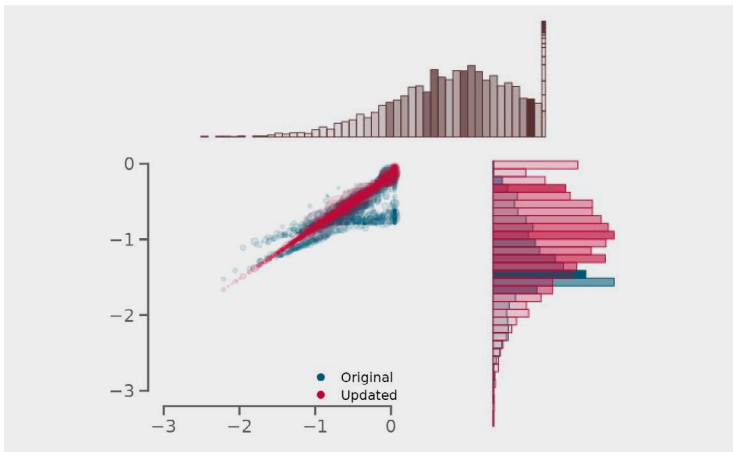
Elder Research combined a strong theoretical understanding with clarity of communication to unpack the details of the client's models and then describe how changes to the system would impact the business. The Elder Research team also developed novel visualizations for business stakeholders and the client's data scientists that explored the client's models in new, practical ways.



RESULTS

Elder Research developed and delivered an updated price elasticity regularization process that intelligently adapts to its inputs, compressing values only if necessary—and only as much as is required to meet business criteria. The strength of this processing is captured in a single, interpretable value that can serve as a model diagnostic. We provided implementations of this new process in both the Python and R programming languages, and the new approach has begun to be incorporated by the client's data science teams.

Combining technical expertise with clear communication, Elder Research effectively collaborated with key business stakeholders and the client's data science teams. This led to solutions that fit into existing workflows and provide business customers with the information they need. Additionally, the client's data science teams plans to incorporate some of the novel visualizations and model understanding from this project into their own tooling.



Diagnostic figure, shared with client experts, that uses multiple visualization channels to compare different regularization techniques. The figure compares two methods (original, in blue, vs. an updated method, in red) across two situations (left and right panels), plotting how each method's output (y-axis) does or doesn't change the original data values on the x-axis.

While achieving the client's goals, the new method also preserves much of the original variation in the data: the red points lie along a straight diagonal line, and the red histogram in the margin is approximately as wide as that of the original data (brown histogram at top). The previous method, however, strongly compressed parts of the signal, resulting in a much narrower range of outcome values (blue points and blue histograms in the margins).

ABOUT ELDER RESEARCH

Elder Research is a recognized leader in the science, practice, and technology of advanced analytics. We have helped government agencies and Fortune Global 500® companies solve real-world problems across diverse industries. Our areas of expertise include data science, text mining, data visualization, scientific software engineering, and technical teaching. With experience in diverse projects and algorithms, advanced validation techniques, and innovative model combination methods (ensembles), Elder Research can maximize project success to ensure a continued return on analytics investment.

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