Computing Price Elasticities with Regression Analysis

Background

- Objective: to gain insights on how the demand side of the market works, i.e. how the demand for a product changes when market conditions (primarily the price), change.
- Models are based on microeconomic theory of consumer's behavior: demand for a product is the result of utility (or satisfaction) maximization under a budget constraint.
- The demand function is computed using an econometric regression, which refers to the use of an advanced statistical model to fit data.
- Two sets of elasticities can be computed:

  (a) own elasticity: how demand for a product reacts to a change in its own price

  (b) cross-elasticities: change in demand after a change in competing products' prices).

How it works

- Sales and price data are collected, usually at the POS, but sometimes at the market level. Data can be time series (one product, several periods of time), cross-section (several products, one period of time) or panel (several products, several periods of time) depending on data availability.
- At the very least, the data must include sales volumes and price levels. Additional variables are usually included to "control" for variations in demand not related to price changes (promotions, seasonality, advertising, etc.) Prices of competitive products are required to compute cross-elasticities.
- Main modeling issue: price is treated as a given in the model whereas in reality, its value depends on the firm's expectation of sales volumes and profits. This double causality can generate misleading results and is addressed by the use of advanced modeling techniques (instrument variables).
- The choice of estimator depends on the structure of the data (time series vs. cross-section vs. panel) and on the functional form used to model the demand. Commonly used estimators include Logit, Probit and Bayesian methods (for discrete choice variables), log-linear and log-log (for continuous variables), autoregressive models (for time series).

Pros

- Flexible modeling techniques: models can be customized based on data structure and availability and on the issue investigated. Modern techniques can allow different elasticities when the price increases and decreases.
- POS data are becoming increasingly available and detailed, improving the accuracy of models.
- The model can be used and updated on an ongoing basis (e.g. monthly or quarterly) in order to keep elasticities accurate.
- These models can prove useful for strategic pricing, especially on strongly competitive markets or during price wars.

Cons

- If there is little variation of prices over time, the model does not fit well and little information can be produced.
- These models require high quality data, as disaggregated as possible. Finding adequate "instruments" to address the double causality issue can prove to be challenging.
- The models are efficient on the short term only and need to be updated frequently. On the long term, forecasts without an updated model can be hazardous because price-elasticity can change due to external factors (new technology available on the market, new competitors, etc.)

Reference: Liu, Q., T. Otter and G.M. Allenby (2009): "Measurement of Own- and Cross-Price Effects", in "Handbook of Pricing Research in Marketing", eds. V.R. Rao, Edward Elgar Publishing.