

GM&A Elasticities

Dataset

- Granularity: Item/Store/Week where Item is UPC or at a minimum a Group Code
- Facts:
 - Sales Units with all promo vehicles (ex. No Promo Sales Units, Flyer Only Sales Units, CPP Only Sales Units, etc.), Base Units, Incremental Units
 - Sales Dollars with all promo vehicles (ex. No Promo Sales Units, Flyer Only Sales Units, CPP Only Sales Units, etc.), Base Dollars, Incremental Dollars
 - Prices would be automatically calculated by dividing Sales Dollars by Sales Units for all promo conditions
 - Distribution: No of Stores Selling, Numerical Distribution, Weighted Distribution. All these measures should be weekly
- Periods: dataset should contain minimum 104 weeks of data
- Exclude Weeks: allow user to exclude certain weeks manually (ex. Covid Spike) if needed. By default, consider all weeks in the dataset which is 104 weeks of data.

Step 1: Data Prep

- Ensure that the data is complete, and periods are consistently spaced over the 104-week period. Use latest 104 Weeks of data to calculate regular price elasticity and 52 weeks for promo price elasticity and promo multipliers.
- Identify base units and prices. Separate base units sold (dependent variable) and regular prices (independent variable) for each week.
- Smoothen Regular Price.
- Control for Seasonality. Seasonality helps us account for base rate sales change at different times of the year and this change is independent of price/promo (ex. Ice cream sales spike in the Summer months).
- Remove Outliers:
 - Filter out weeks where price/volume relationship is unexplainable (increase in price should result in decrease in demand, hence the price elasticity should be negative)
 - Algorithmically filter out abnormal/extreme spikes and dips in sales
 - Filter out weeks that user decided to manually exclude: “Exclude Weeks” (ex. Covid spike) Panic buying periods should be removed as they will confuse the model and result in positive price elasticities

Step 2: Modeling

- Regular Price Elasticity
 - Smoothen Regular Price
 - % Change in Price = $\log(\text{new regular price} / \text{old regular price})$
 - % Change in Quantity = $\log(\text{new weekly base units} / \text{old weekly base units})$
 - Elasticity = % Change in Quantity / % Change in Price
- Promo Price Elasticity & Promo Multipliers:
 - % Change in Price = $\log(\text{Promo Price} / \text{Regular Price})$
 - % Change in Quantity = $\log(\text{Instore without Flyer or Display Units} / \text{Base Units})$
 - Elasticity = % Change in Quantity / % Change in Price
 - Multiplier for Promotional Conditions = $\text{Lift on Promo} / ((\text{Promo Price} / \text{Regular Price})^{\text{Elasticity}})$

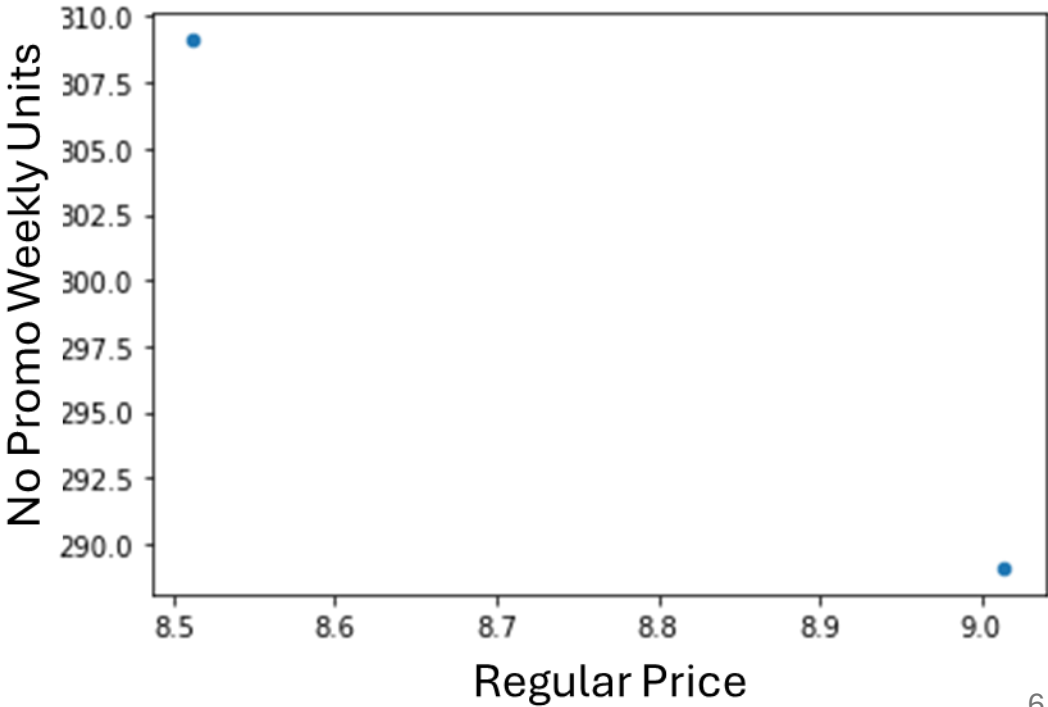
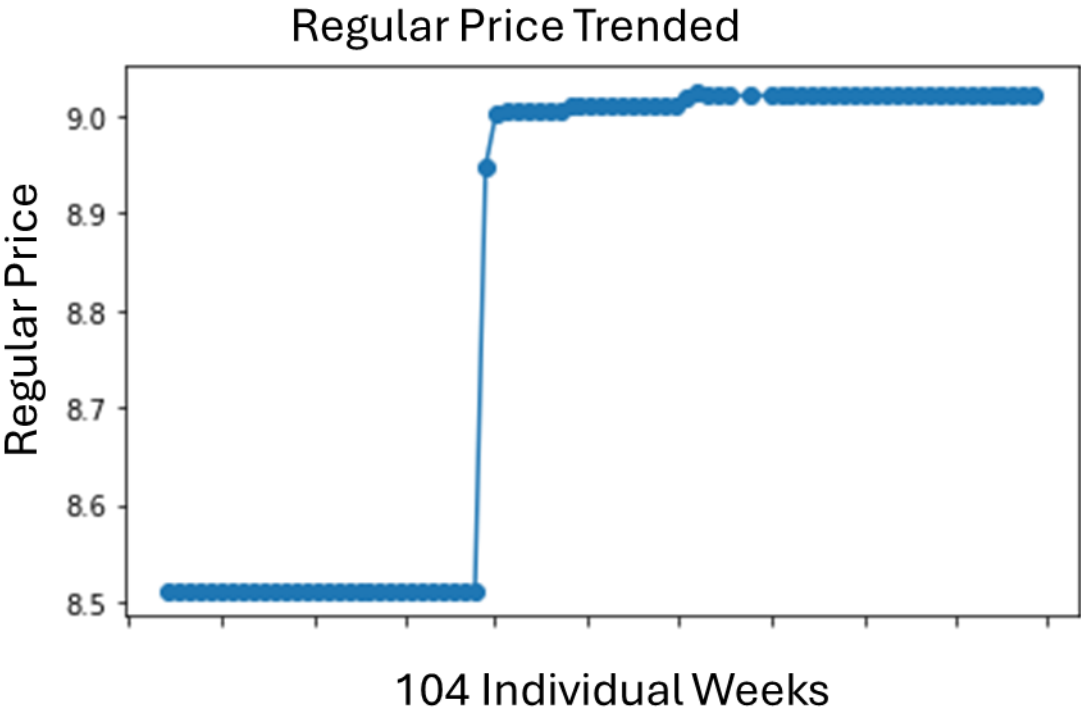
Step 3: Imputation & Validation

- Round elasticities and multipliers to 2 decimal points (ex. -1.17)
- Roll up elasticities (product and market) using weighted average. Elasticities should be available at all levels of the hierarchy such as Fineline, Category, Department, SBU
- Apply governors (ex. Flyer Multiplier >1.00, Flyer with CPP Multiplier > Flyer Only Multiplier) and override original coefficients. We should not have any multipliers less than 1.00.
- Fill in coefficients in cases of insufficient data (ex. UPC had no regular price change). Use the parent coefficient from the level above (ex. Fineline)
- Validate results and create validation summary:
 - R2
 - MAPE
 - Elasticity ranges and item distribution (min, max, % of items falling in each elasticity bucket)

Example: Regular Price Elasticity

Regular Price Elasticity: = LOG(289.1/309.1) / LOG(9.01/8.51) = -1.17

Regular Price	Price Buckets	Weeks	Avg Weekly Units
\$8.51	\$8.43-\$8.65	36	309.1
\$9.01	\$8.88-\$9.10	68	289.1



Example: Promo Price Elasticity and Multipliers

Lift = Total sales/ baseline sales

Elasticity = $\text{Log}(\text{Lift}) / \text{Log}(\text{Average Price} / \text{Regular Price})$

Multiplier = $\text{Lift} / ((\text{Average Price} / \text{Regular Price})^{\text{Elasticity}})$

No Promo Week:

Regular Price: \$5.97

Base Units per Week: 8,441

Instore Promotion:

Promo Price: \$4.97

Units per Week when on Promo Instore: 14,470

Promo Price Elasticity: $\text{LOG}(14,470/8,441) / \text{LOG}(\$4.97/\$5.97) = -2.94$

Front Page Flyer Promotion:

Promo Price: \$4.97

Units per Week when features in the Front Page Flyer: 17,642

Front Page Flyer Multiplier: $(17,642/8,441) / ((\$4.97/\$5.97)^{-2.94}) = 1.22$

CPP Promotion in All Stores:

Promo Price: \$4.97

Units per Week when features in the Front Page Flyer: 26,640

Front Page Flyer Multiplier: $(26,640/8,441) / ((\$4.97/\$5.97)^{-2.94}) = 1.84$

Front Page Flyer + CPP Promotion in All Stores:

Promo Price: \$4.97

Units per Week when features in the Front Page Flyer: 32,640

Front Page Flyer Multiplier: $(32,640/8,441) / ((\$4.97/\$5.97)^{-2.94}) = 2.26$