REPORT 3

BUAN 6337: Predictive Analytics for Data Science

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Section 501

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Introduction

 Meat substitutes are a polarizing and growing market in vegan, vegetarian, and flexitarian communities. In our initial market research, we sought to identify key areas where Gardein can revise its playbook to make a larger impact across the United States. Initial analytics suggested both regional trends in sales as well as personal preferences for certain forms and flavors. These initial indicators of differentiation led us to construct a model that considers the impact of price sensitivity, form, flavor, and product type on sales. With additional time and research, further conclusions could focus on specifics of price promotion sensitivity, specific flavor and form variations that could be eliminated from Gardein's catalog, and opportunities to gain market share from competitors based on targeted marketing strategies.

Market Research and Competitor Analysis

Regional Trends and their Impact on the Meat Substitute Market

Regional differences are the standard in American eating habits, and this clearly seen in both political ideology and primary diets. One of the main contributors that are influencing the adoption of meat substitutes is political ideology. In general, regions that are adopting meat substitutes as expected are "blue" states, with more liberal political ideologies. Liberal political stances align with two key drivers for users who buy meat substitutes: Animal cruelty and sustainability (44%) and the environment (19%) (Wunsch, 2024). Another key contributor is the primary diet of the region. For example, the Midwest and southern/central regions of the United States are the highest producers of beef and corn (Morris, 2021). Logically, they are amongst the lower consumers of meat substitutes. Given that this region is a key producer and a key consumer, it may mean that meat substitutes are less valuable to the inhabitants. While no single regional trend is a clear indicator of product performance, both political ideology as well as diet appear to influence how developed the meat substitute market in. To further study these influences, we analyzed each region individually for trends. By measuring product performance region to region, it could be determined if Conagra could improve market development by having a region-specific sales approach.

Competitor Analysis for Gardein

Despite Gardein's established brand presence across the United States, the meat substitutes market remains highly competitive, characterized by its niche nature. This environment fosters market saturation and intensifies rivalry among competitors, all striving to capture consumer attention and secure a larger market share. Two key themes arise, the difference in the pricing structure between Gardein and its competitors, and its marketing approach. To effectively benchmark Gardein's performance against its primary competitors—Morning Star Farms, Beyond Meat, and Impossible—a comprehensive competitor analysis is imperative for Gardein to maintain its competitive edge in this dynamic market landscape. To study these trends and impacts, we considered price sensitivity, flavor, form, and product type as the core features for our models.

It is seen that for three of the top five products - burger patties, chicken nuggets, and breakfast sausages – Gardein is the most expensive option out of the four companies (Morning Star Farms, Beyond Meat, and Impossible). On the contrary, the #1 ranked company, Morning Star Farms, has competitive pricing for all five products, positioning it as an attractive option for cost-conscious consumers. This suggests that while Gardein may excel in certain aspects such as product quality or brand reputation, Morning Star Farms holds a significant advantage in terms of pricing strategy, potentially widening its consumer base and market share. This emphasizes the importance for Gardein to reassess its pricing approach and consider marketing strategies to remain competitive in the market landscape.

There is also a significant difference in how Gardein markets its products on its website compared to other companies. Gardein categorizes its products primarily by the type of meat it is substituting, with major groups including chicken/turkey-less, beef/pork-less, and fish-less options. In contrast, other companies, such as Morning Star Farms, and Beyond Meat, choose to market their products by grouping them based on meal type, including burgers, breakfast, sausages, and meal starters. This difference in marketing approach suggests that while Gardein focuses on the specific type of meat being substituted, other companies offer a more diversified and consumer-centric categorization based on meal types. This strategy could potentially be more appealing to consumers who are looking for specific meal options rather than focusing solely on the type of meat being replaced.

Questions Solved and Recommendations

Overall Recommendation:

Each **Region** requires a separate approach for **promotions, product forms** and **product flavors**.

To determine the best approach for each region, we studied the impacts of price sensitivity, promotion, product form and product flavor within each region to answer the below questions:

1. How price-sensitive is each region?
2. How does each region respond to promotions?
3. Do different regions have different preferences on product forms and/or flavors?

Data Cleaning

Initial Data Inspection

Initially combined the Frozen meat substitutes POS sales data from 2020-2023. Then attached the product attributes excel to bring in different product attributes such as (Form, Flavor, Product Type, Type of Meat Substituted). Converted the 'Week Ending In' into Date Time format and extracted the Month, Year, and Season. Using delimiters, brought out the region from 'Geography' column. Standardized and cleaned up the column names using the JANITOR library. Filtered out everything other than "Gardein" from the data. The categorical variables were standardized, and common classes were combined, to reduce the number of overall classes, to capture more general trends in the dataset.

Collinearity and Heatmap Analysis

As we look for all the relationships between different factors to account for potential insights, we also must consider the possibility that other biases could create misinformation. The creation of a Heatmap graph was needed to check for any collinear variable that might result in the improper diagnosis of the data. It displays the correlation coefficients between various factors in the dataset ranging from -1 to 0 to 1 i.e., negative correlation to no correlation to positive correlation.
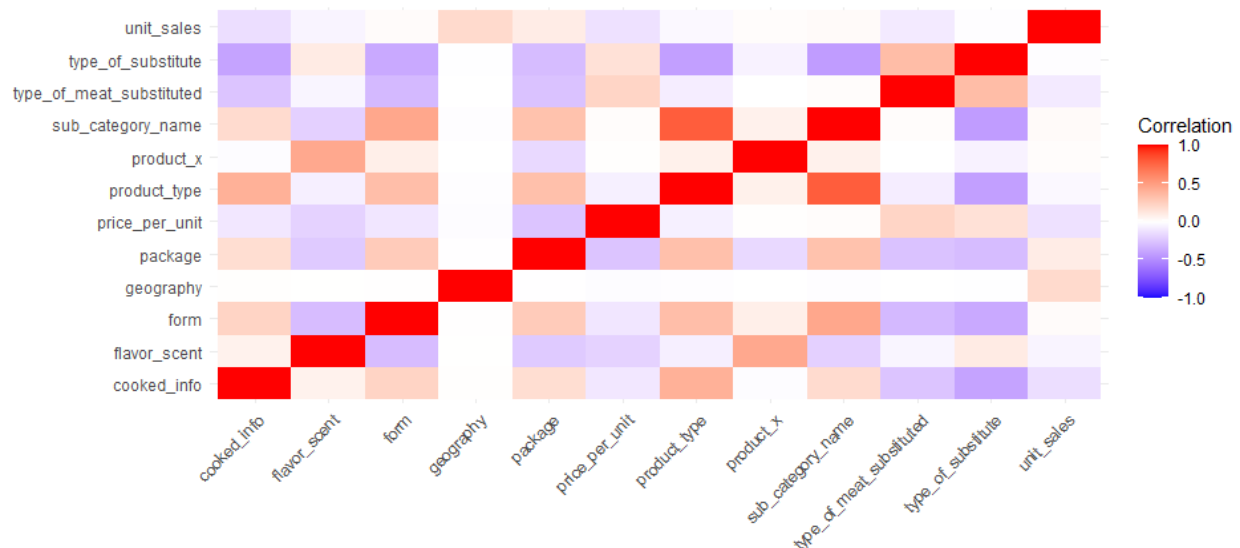
The key finding here is that most relationships revealed no significant correlations. The only strong correlation includes variables that are clearly connected, such as a strong positive correlation between product type and sub-category name. This relationship is not an issue as the variables were connected even before the data was produced since the sub-category is inherently a part of the category type. Some minor correlations, while not statistically significant, include the relationship between types of substitutes and product types. This connection is reasonable because similar products often use similar substitutes. However, it is important to note that this conclusion may be less reliable due to the limited diversity of observations for certain variables. To complete the Heatmap, each categorical variable had to be converted into numbers resulting in some categories only having a few numerical answers.

In conclusion, this analysis revealed that there was no real collinearity between distinct variables that were not already connected from the start. With this, we can move forward without the idea of misunderstanding which variables had an actual impact on sales and profits. By understanding that there is little to no collinearity, we can create more informed pieces of advice to optimize Conagra's marketing and sales strategies.

Category Standardization

▇ (cyan)	Form
▇ (green)	Product Type
▇ (magenta)	Flavor
▇ (yellow)	Type of Meat Substituted

For the following section, the original attributes are placed inside of brackets, [] and corresponding replaced category in "". These standardizations were based on domain knowledge, group consensus and market research. The *Form* variable initially had 71 classes and was grouped into 7 classes, *Product Type* was reduced from 18 classes into 4 classes, *Flavor* went from 379 classes initially into 16 classes, and *Type of Meat Substituted* was reduced from 43 classes into 10 classes. The final classes used in our analysis are represented below based on the colors in the legend.

Form

[Strip, Filet, Cutlet, Breast, Roast, Steak, Spareribs, Riblet, Cut, Meat Loaf] -> "FILET/STRIP"

[Meat Loaf, Crumble, Ground, Diced, Shreds, Shredded] -> "GROUND"

[Link, Frank, Breakfast Link, Sausage, Hot Dog, Bratwurst, Dinner Link, Breakfast Sausage Link, Dinner Sausage Link, Breakfast Sausage Roll] -> "LINK"

[Meatball, Ball] -> "MEATBALL"

[Nugget, Tenders, Wing, Tender, Bite, Dipper, Popper, Finger, Fun Nugget] -> "NIUGGET/TENDER"

[Tip, Chunk, Cube, Block, Cake, Piece, Bao Bun, Stick, Fries, Chub, Rope, Pulled, Bings, Roll, Popcorn, Whole, Bar, Drumstick, Split Rope, Loaf, Breakfast Bites, Gizzard, Not State on Package] -> "OTHER"

[Patty, Burger, Burger Patty, Slider, Breakfast Patty, Breakfast Sausage Patty, Sausage Patty] -> "PATTY/BURGER"

[Sliced, Slice, Deli Sliced, Ultra-Thin Sliced] -> "SLICED"

Product Type

[Tofu, Soy, Seitan, Tempeh, Falafel, Plant Based Substitute, Tofu Substitute, Soy Substitute, Tempeh Substitute] -> "NON-MEAT"

[Meat Substitute, Burger, Vegetable Meat Substitute] -> "MEAT"

[Fish Substitute, Seafood Substitute] -> "SEAFOOD"

[Poultry Substitute, Chicken Substitute, Plant Based Chicken Substitute, Plant Based Turkey Substitute] -> "POULTRY"

Flavor

[5 Spice, Asian, Asian Vegetable, Chicken Sesame Garlic, Chicken Thai Basil, General TSOs, Ginger, Ginger Scallion, Kimchi, Korean, Korean Barbeque, Korean Style Barbeque, Mango & Basil, Sesame Garlic, Sesame Ginger, Sizzling Szechuan, Spicy Sichuan, Spicy Thai, Sriracha Thai Chili, Sweet & Sour, Sweet & Spicy Pepper, Teriyaki, Thai, Thai Coconut, Citrus Sparerib] -> "ASIAN"

[Barbeque, Barbeque Chicken, Barbeque Sauced, Barbeque Seasoned, Chicken Barbeque, Coal Roasted, Grandpa Mels Barbeque, KC Barbeque, Raspberry Habanero Barbeque, Smoked, Smoked Hickory

Barbeque, Smoky, Smoky & Spicy, Smoky Sausage, Sweet Barbeque, Sweet Barbeque Chicken, Wood Smoked] -> "BARBEQUE"

[Apple Maple, Apple Sausage, Applewood Smoke, Applewood Smoked, Bacon, Breakfast Sausage, Breakfast Crumble, Canadian Bacon, Chicken Apple Sausage, Huevo Rancheros Breakfast, Maple, Maple Sausage, Sausage, Smoked Apple Sausage, Smokey Savory Maple, Smoky Maple Bacon, Sweet Apple] -> "BREAKFAST"

[Cheddar, Cheese]-> "CHEESE"

[Fish, Lemon Dill Salmon]-> "FISH"

[Baja, California, California Style, Caribbean Style Plantain, Cranberry & Goat Cheese, Garden, Garden Broiler, Garden Fresh, Juicy, Lemon]-> "FRESH"

[3 Grain, 5 Grain, 7 Grain, Grain & Seed Medley, Lentil, Lentil Barley, Lentil Sage, Lupini Bean, Multi Grain, Quinoa, Quinoa Crunch, Roasted Garlic & Quinoa, Sprouted Qunioa Chia, Sunrise, Sunrise Trail Mix, Sweet Potato & Red Quinoa, Walnut, Walnut & Cheese]-> "GRAIN"

[Basil Pesto, French Herb, Garden Herb, Garlic & Herb, Grain & herb, Herb & Spice, Herb Roasted Herby Garlic Greens, Hickory & Sage, Hickory & Sage Smoked, Hickory Smoked, Lemon Herb, Lemon Pepper, Parmesan Garlic, Season & Lime, Seasoned, Sun Dried Tomato & Spinach, Sun Dried Tomato Basil]-> "HERB"

[Bombay Curry, Chickpeas & Curry, Coconut Curry, Curried Sweet Potato, Curry, Indian Spiced Masala, Madras Curry, Masala, Spicy Indian Vegetable, Spicy Indian, Sweet Curry Carrot, Tandoori Spice]-> "INDIAN"

[Chicken Scaloppini, Chicago Italian, Classic Pizzeria, Hot Italian, Italian, Italian Garlic & Fennel, Italian Pepperoni, Italian Sausage, Italian Style, Kielbasa, Mama Mia Spicy Italian, Mild Italian, Parmigiana, Pesto Mozzarella, Pizza Pepperoni, Salami, Savory Tuscan Style, Spicy Italian, Spicy Italian Hempseed, Sweet Italian, Tomato & Basil Pizza, Tuscan Vegetable Sausage, Zesty Chicken, Zesty Italian]-> "ITALIAN"

[Black forest Ham, Bologna, Philly Steak]-> "LUNCHMEAT"

[Adzuki Bean & Sweet Potato, All-American, All-American Vegetable, Beer, Black Rice, Corned Beef, Elysian Beer, Flax, Garlic, Greek, Greek Moussaka, Hot Dog, Katsu, Mediterranean, Mediterranean Chickpeas, Moroccan, Perfect, Sonoma, Spanish Smoked, Swedish, Truffle, Zesty Ranch]-> "OTHER"

[Chicken, Chicken Lightly Seasoned, Ham, Ham Style Roast, Beef, Bratwurst, Butter, Buttermilk, California Burger, Celebration, Char Grilled, Classic, Flame Grilled, Grilled, Ground Beef, Homestyle, Lightly Seasoned, Meat Lovers, New England Style, Nutty, Original, Original Beefy, Original Brat, Original Sausage, Original Turkey, Oven Roasted, Oven Roasted Turkey, Regular, Roast, Roasted Turkey, Salisbury Style, Salt & Pepper, Savory, Savory Chicken, Sea salt & Pepper, Signature Stadium Dog, Simply Seasoned, Smoked Ham, Smoked Salt & Pepper Steak, Spinach Chicken, Steak, Steakhouse Style, Sunday Funday, Sweet & Savory, Sweet & Original, Sweet & Tangy, Tasty, The Big Fry, The Classic, The OG, The Stallion, Traditional, Turkey, Turkey Roast, Ultimate, Ultimate Black Bean, Unseasoned, Vegetable Chicken, Vegetable Griller Original, Vegetable Griller Prime, Vegetable Lovers, Vegetable Meat Lovers, Vegetable Pork, Vegetarian]-> "REGULAR"

[Black Pepper, Black Pepper Beef, Buffalo, Buffalo Style Cauliflower, Buffalo Tempeh, Cajun, Chick Peas & Red Pepper, Chili Bean, Cracked Black Pepper, Extreme, Feisty, Green Chile & Pinto Bean, Green Chile Cheddar, Hot & Spicy, Hot & Spicy Sausage, Jalapeno, Jalapeno & Cilantro, Kicking, Mango Chipotle, Mild Hot, Nashville Hot, Nashville Hot Chicken, Pepper Seasoning, Pepper Steak, Peppered, Pineapple Chipotle, Pinto Habanero, Saucy Buffalo, Spicy, Spicy Buffalo, Spicy Chicken, Spicy Falafel, Spicy Garlic, Spicy Green Chili, Spicy Habanero Chicken, Spicy Jalapeno, Spicy Mushroom, Spicy Sausage]-> "SPICY"

[Fiesta Black bean, Big Tex, Chipotle, Chipotle Black Bean, Chipotle Lime, Chorizo, Cowgirl, Mexican, Mexican Chipotle, Poblano Black Bean, Santa Fe, Smoked Salsa Chipotle, Southwest, Southwest Adzuki Bean, Southwest Black Bean, Southwest Style Beet, Southwestern, Spicy Black Bean, Spicy Chipotle Black Bean, Taco, Tex Mex, Zesty Mexican]-> "TEXMEX"

[Artichoke, Bean, Beet, Beet & Kale, Beetroot & Bean, Black Bean, Black Bean & Pineapple, Black Bean & Plantain, Black Bean & Vegetable, Black Bean Chipotle, Black Bean Quinoa, Broccoli Boost, Brown Rice & Garbanzo & White Bean, Bubba, California Vegetable, Carrot, Cauliflower, Chick Peas & Sunflower, Chick Peas & Tahini, Chick Peas Sweet Potato, Eggplant, El Capitan, El Guapo, El Zapatista, Falafel, Falafel & Sesame, Garden Variety, Garden Vegetable, Green & Bean Medley, Grilled Vegetable, Harvest Blend, Hazelnut Cranberry, Heirloom Bean, Hempseed, Kale, Kale & Quinoa, Multi Vegetable, Mushroom, Mushroom & Cheese, Mushroom & Vegetable, Mushroom & Wine, Mushroom Miso, Mushroom Quinoa, Mushroom Rice, Mushroom Risotto, Peas & Carrot, Peppadew, Peppadew Pepper, Peppadew Piquante Pepper, Portabello, Portabello Mushroom & Cheese, Portabello Quinoa, Pumpkin & Spinach, Roasted Beet & Kale, Root Vegetable, Savory Mushroom, Savory Mushroom & Roasted Garlic, Savory Orange, Savory Original, Savory Vegetable, Savory Vegetable Sausage, Shiitake Mushroom, Smoked Tomato, Spinach, Spinach Pesto, Summer Harvest, Sunflower Beet, Super Cauliflower, Super Greens, Sweet Heat Beet, Sweet Pepper, Sweet Potato, Sweet Potato & Vegetable, Sweet Potato Sunflower, Sweet Sunshine Corn, Tomato & Spinach, Tuscan kale White Bean, Vegan, Vegetable, White Bean & Kale, White Bean Chili, White Truffle & Black Bean, Wild Mushroom, Wild Mushroom Cauliflower Hempseed] -> "VEGETABLE"

Type of Meat Substituted

[Beef, Carne Asada Steak, Meatloaf, Steak, Corned Beef, Roast Beef] -> "BEEF"

[Burger]-> "BURGER"

[Chicken, Chicken and Pork]-> "CHICKEN"

[Meatball, Italian Meatball]-> "MEATBALL"

[Tofu]-> "NON-MEAT"

[Pork, Bacon, Ham, Pork Bacon]-> "PORK"

[Pastrami, Salami, Italian Deli Meat]-> "SANDWICH"

[Sausage, Italian Sausage, Hot Dog, Brat, Andouille Sausage, Chorizo, Pork Sausage, Prosciutto, Pepperoni, Carpaccio, Longaniza, Frankfurter, Bologna, Bratwurst, Belt Fish]-> "SAUSAGE"

[Fish, Crab, Salmon, Tuna, Shrimp]-> "SEAFOOD"

[Value Not Available, N/A, Tempeh]-> "UNK"

Data Segmentation

The initial dataset was the Frozen Meat Substitutes data, split by year. The data for the years 2020, 2021, 2022, and 2023 were combined. 2024 data was left out of the analysis, as it is incomplete and would not accurately reflect a whole year's trend. Overall, the initial dataset had 991,780 observations of 58 variables. The analysis was to be primarily focused on the Gardein brand, so data segmentation was done to get a subset of just this data (*brand* = 'Gardein'). The dummy variables were also included based on the category standardization, and the final dataset, 'Gardein.csv,' consisted of 64,337 observations of 104 variables.

Initial Evidence of Significant Features

ANOVA Tests

ANOVA testing evaluates the differences in average sales across the following categories: region, season, form, and flavor. A key assumption of ANOVA is normality within each factor's distribution. Since the sample sizes are large enough for category, however, this assumption can be bypassed due to the central limit theorem.

According to the box plots below, the mean sales (indicated by the black dots inside the boxes) appear to vary for all four of the categories except for season. The Welch ANOVA tests – which are used when variances are unequal – for region, form, and flavor confirm that there is a significant difference in the average unit sales among the factors within each of these categories. The apparent outliers in each of these categories might be a contributing factor to the varying means.
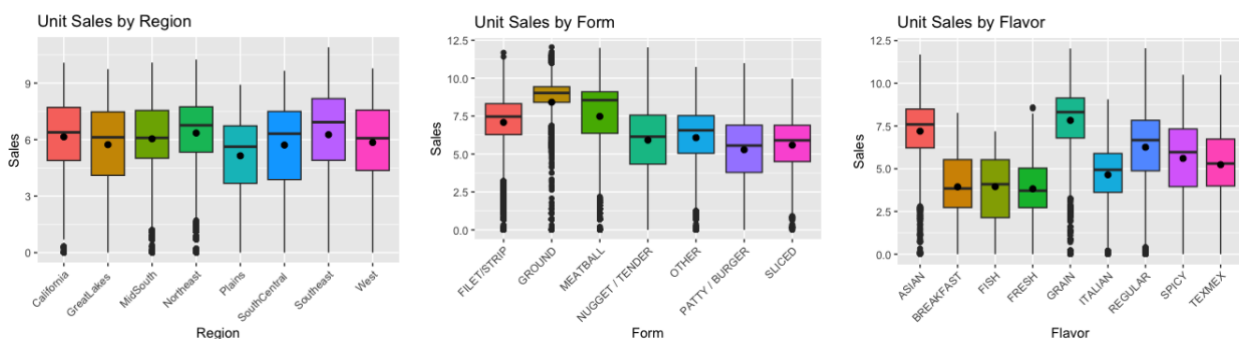
The average sales for each season appear to be the most similar, and Levene's test reveals that the variances are not significantly different. A regular ANOVA test, however, still shows a significant difference in the average sales among the seasons. The results of these ANOVA tests signal that further analysis, such as regression, could reveal the magnitude in which these factors, as well as others, might influence sales.

Unit Sales by Season
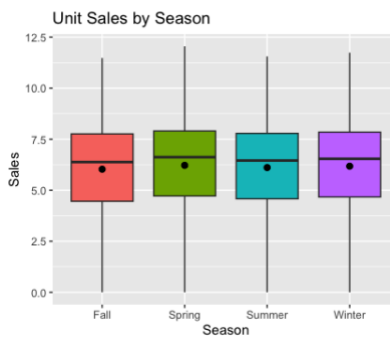
Chi Square Tests

Region and Flavor
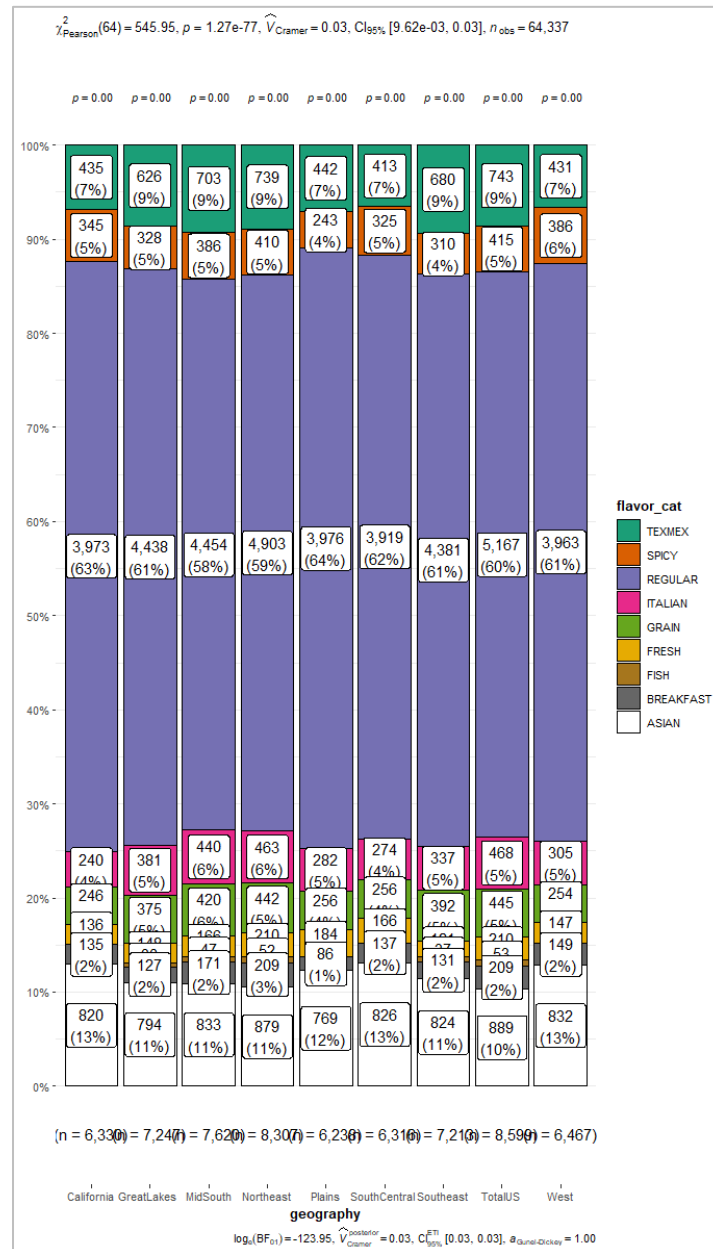
After market research, we had the hypothesis that different regions would have different preferences for meat substitute flavors. Using the standardized names, we ran a chi-square test to determine the statistical significance.

Based on the above results, we can see that the p-value is < 0.05, and therefore the relationship between regions and flavors is significant. For example, we can see that the flavor 'regular' is the most prevalent flavor across all regions, but how much of the market it captures is different for each specific region. In the south, it is only 58% of the total market consumed, but in the Plains, it is 64%. This test and

its results indicate that we should study this relationship further and include both *region* and *flavor* as core features in our model.

Region and Form

$\chi^2_{Pearson}(48) = 279.68, p = 1.91\text{e-}34, \widehat{V}_{Cramer} = 0.02, CI_{95\%} [3.95\text{e-}03, 0.03], n_{obs} = 64{,}337$

p = 0.00	p = 0.00	p = 0.00	p = 0.00	p = 0.00	p = 0.00	p = 0.00	p = 0.00	p = 0.00

form_cat
- SLICED
- PATTY / BURGER
- OTHER
- NUGGET / TENDER
- MEATBALL
- GROUND
- FILET/STRIP

California (n = 6,330): 211 (3%), 1,977 (31%), 490 (8%), 1,573 (25%), 224 (4%), 268 (4%), 1,587 (25%)

GreatLakes (n = 7,247): 222 (3%), 2,448 (34%), 532 (7%), 1,762 (24%), 351 (5%), 265 (4%), 1,667 (23%)

MidSouth (n = 7,620): 308 (4%), 2,628 (34%), 523 (7%), 1,823 (24%), 395 (5%), 269 (4%), 1,674 (22%)

Northeast (n = 8,307): 332 (4%), 2,981 (36%), 528 (6%), 2,001 (24%), 412 (5%), 264 (3%), 1,789 (22%)

Plains (n = 6,238): 210 (3%), 1,992 (32%), 541 (9%), 1,488 (24%), 223 (4%), 259 (4%), 1,525 (24%)

SouthCentral (n = 6,316): 211 (3%), 2,072 (33%), 518 (8%), 1,524 (24%), 217 (3%), 262 (4%), 1,512 (24%)

Southeast (n = 7,213): 262 (4%), 2,409 (33%), 535 (7%), 1,720 (24%), 382 (5%), 264 (4%), 1,641 (23%)

TotalUS (n = 8,599): 342 (4%), 3,044 (35%), 569 (7%), 2,018 (23%), 477 (6%), 313 (4%), 1,836 (21%)

West (n = 6,467): 205 (3%), 2,132 (33%), 518 (8%), 1,568 (24%), 222 (3%), 257 (4%), 1,565 (24%)

geography

$\log_e(BF_{01}) = 11.44, \widehat{V}^{posterior}_{Cramer} = 0.03, CI^{ETI}_{95\%} [0.02, 0.03], a_{Gunel\text{-}Dickey} = 1.00$

Additionally, as part of market research, our group believed that form would be different across regions. We used a Chi-test to evaluate this as well and found that the relationship once again had a p-value < 0.05, making it significant. Between this result and the inferences from our market research we determine that *form* should also be a core feature in our final regression model.

Collinearity for Flavor, Form, and Type of Meat Substitute

Through the numerous regression equations and correlations between all the variables, we realize that the main points of error to focus on are surrounding the results of three of the original variables. These three are the flavor, the form, and the type of meat substitute. While using these variables to find out the impact of each flavor, each form, and each type of meat substitute, we also need to check for the potential error that might hit our data points. To eliminate the potential errors, three heat maps were created to measure the collinearity between each variable result against each other.
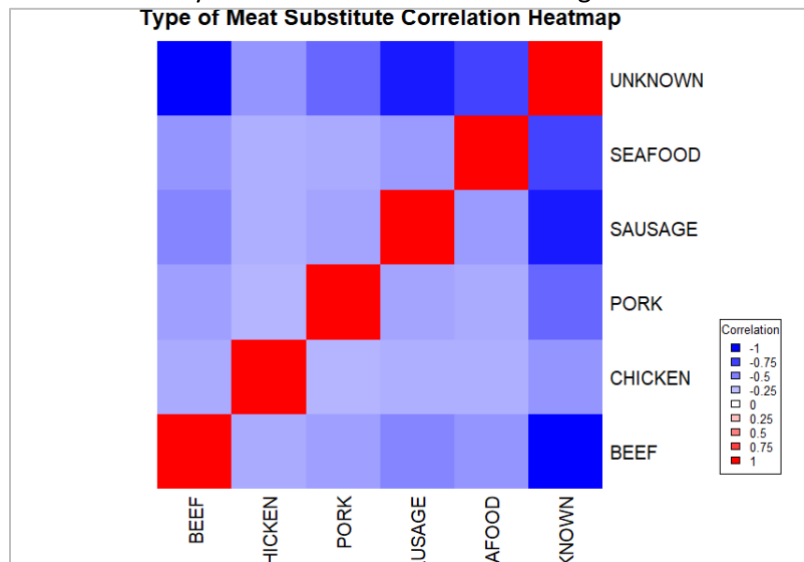
As one of the three heat maps, the Type of Meat Substitute Heatmap was the only one shown to have collinearity outside of our regulated threshold (-0.5 to +0.5). With a correlation coefficient of -0.55, it shows that when testing the Unknown indicator to the Beef indicator, we should not use them when creating the best-fitted line due to the error that they bring to another. With this knowledge, there are a few paths we can take. One is to drop one of the variables from our regression lines. Two, combine them into an aggregate measure to create a composite variable that includes the values of both the others. Three, to collect more data to find different variations between the variables.

The heat maps for the variables in Flavors and Forms (as shown in the appendix), reveal that all the correlation coefficients are inside our threshold of -0.5 to +0.5. This means that there is not a significant amount of collinearity between any of the variables permitting us to use them in our regression line without the risk of errors polluting the data and then our main points of advice.

In conclusion, this analysis concluded that there was only one main pair of correlation coefficients that might inflict some type of error on our regressions, but it should not impact our data since collinearity creates noise but not much error. An example is how one of our variables would be considered important when it is not, but even with this error, it should not alter our regression equation toward the wrong outcome.

Regression Models

Findings

California

- Promotions: They are the most effective when products are on display with an increase in sales of 1067, followed by unit reductions, which increase sales by 955 units. In contrast, the least effective is only featuring the product, which increases sales by a minimal 303 units.
- Product Type: The non-meat product types are the least popular, with a mild hit on sales in this region of 25 units.
- Form: In the product forms, the top-3 most popular forms contributing to highest positive impact on sales include ground, meatball, and fillet, with an increase in sales units by 9914, 5465, and 883, respectively. It is worth noting that ground is 1.7x more than the next most popular form, so marketing focus in this region should be on the ground. The least impactful forms in this region are patties and sliced, both with negative sales of 573 and 285 units, respectively.
- Flavor: The most impactful flavors in this region include grain and Asian, with positive sales of 6732 and 870. The least popular flavors here all have negative impact of sales, with Italian decreasing sales by 401 units, fresh by 316 units, and breakfast by 238 units.
- Type of substitute: The least popular is chicken with a decrease in sales of 2520 units, while beef decreases sales by 407 units.
- Time Trend: There is a year by year decrease in sales from 2020 to 2023, going from +2405 units in 2020, to –595 units in 2023. This could be an influence of COVID, since 2020 and 2021 (COVID period) has positive sales, and the post-COVID period of 2022 and 2023 have negative sales.
- Interaction Effects: (Form x Flavor)
    - Asian flavored fillets are positively impactful on sales with +821 sales units.
    - Only grain-flavored nuggets have any positive impact on sales, with an increase of 190 units. All other flavors of nuggets have a negative impact on sales units.
    - Patties are the most popular in the regular (+193) and spicy (+171) flavors. Italian flavored patties are least popular.
    - Sliced forms either have no or negative impact, no matter the flavor, so it is not worth the resources to market it in this region.
- Pricing Strategy:
    - Increasing the price per unit by $1 in the most impactful forms such as ground and meatball have a negative impact on the sales by 1011 and 122 units, respectively. This means that for every $1 increase in the price for ground form products, there is a drop in units sold by 1011.
    - Increasing the price per unit of products that are less popular, such as patties and seafood, has a mildly positive impact on sales, by +100 units each.

- The price per unit increase had a negative impact on unit sales during the years 2020 and 2021, which already had positive sales. However, for recent years i.e., 2022 and 2023, the increase has a mildly positive impact on sales of +20 to +95 units.

Midsouth

- <u>Promotions</u>: They are most effective when products are on display, leading to an increase in sales of 1,853 units, while the unit reduction results in a 1001-unit increase.
- <u>Product Type</u>: Seafood and non-meat product types are the least popular, resulting in decreases of 934 and 830 units, respectively. The vast availability of fresh seafood in this region could be a plausible reason as to why seafood substitutes negatively impact sales.
- <u>Form</u>: Regarding product forms, ground products boost sales by 16,774 units, followed by meatballs (10,047) and nuggets (2,106). Conversely, sliced and patty forms decrease sales by 395 and 393 units, respectively.
- <u>Flavor</u>: For flavor, Grain products see a 3,974-unit increase in sales followed by Asian flavors contributing 437 units. Fresh and Italian flavors negatively impact sales by 229 and 178 units, respectively.
- <u>Type of Meat Substitute</u>: Substitution with chicken or pork reduces sales by 1,253and 731 units, respectively.
- <u>Time Trend</u>: The year-over-year analysis shows that 2020 and 2021 had much better sales than 2022 and 2023, shifting from positive to negative sales trends. This could be the influence of COVID, since 2020 and 2021 (COVID period) has positive sales, and the post-COVID period of 2022 and 2023 have negative sales.
- <u>Interaction Effects</u>: (Form x Flavor)
    - Fillets performed well in both regular (1,175) and Asian (1,319) flavors.
    - Nuggets underperformed in both Tex-Mex (-1,030) and regular (-762) varieties.
    - Patty gained popularity in regular (395) and Tex-Mex (454) flavors.
    - Sliced forms are not significant enough to justify selling them in this region.
- <u>Pricing Strategy</u>:
    - An increase in price per unit negatively impacts sales of ground (-1,633) and meatball (-936) forms, while favoring less popular products such as seafood, non-meat, patty, and sliced.
    - The price per unit increase had a negative impact of –103 and –21 units respectively on unit sales during the years 2020 and 2021, which already had positive sales. However, for recent years i.e., 2022 and 2023, the increase has a mildly positive impact on sales up to +81 units.

Northeast

- <u>Promotions</u>: They have a positive impact, with the absence of merchandise increasing sales by 4110 units, and product displays contributing an additional 2,117 units.
- <u>Product Types</u>: For product types, non-meat products are the least popular, resulting in a decrease of 1,610 in unit sales.

- Forms: The forms that boost sales the most include ground (20,291 units), meatball (12,576), and nugget (1,352), while patty reduces sales by 1,347 units and is the least impactful to unit sales.
- Flavor: Grain flavor increases sales by 6,635 units, while fresh and breakfast and spicy flavors decrease sales by 235, 215 and 126 units, respectively.
- Type of substitute: When considering substitutes, chicken and beef reduce sales by 1511 and 706 units, respectively.
- Time Trend: Yearly analysis indicates that only 2020 saw positive sales trends, with subsequent years turning more negative.
- Interaction Effects: (Form x Flavor)
  - Fillets perform well in the Asian (+1,062) flavor.
  - Nuggets do not sell well, except in grain flavor (+1,421).
  - Patty is only popular in regular (+367) flavor.
  - Sliced Italian is positive (+887), but regular is negative (-716).
- Pricing Strategy:
  - Increasing price per unit for ground and meatball forms negatively impacts sales by 2,166 and 1,037 units, respectively, while favoring less popular products such as seafood, non-meat, patty, and sliced positively impact the sales slightly.

Plains

- Promotions: They have minimal impact on sales. When products have a unit reduction, the increase in sales is +760 units. When on display, it leads to an increase in sales of 649 units, and features result in a 573-unit increase. However, promotions with feature and display decrease 63 units, which has a negative impact on sales.
- Product Type: Non-meat product types have a negative impact, decreasing sales by 515 units. The product types that have a positive impact include poultry and seafood, with +504 and +308 increases in unit sales, respectively.
- Form: Regarding product forms, ground products boost sales by 7,382 units, followed by meatballs (6,744). Conversely, sliced and nugget forms decrease sales by 259 and 49 units, respectively.
- Flavor: For flavor, grain products see a 1,240-unit increase in sales followed by Asian flavors contributing 148 units. Italian, Tex-Mex, and fresh flavors negatively impact sales by 211, 165 and 159 units, respectively.
- Type of Meat Substitute: Substitution with chicken or pork reduces sales by 1787 and 1657 units, respectively.
- Time Trend: The year-over-year analysis shows that 2020 had much better sales than 2021, 2022 and 2023, shifting from positive to negative sales trends.
- Interaction Effect: (Form x Flavor)
  - Fillets performed well in both Regular (+1723) and Asian (+1268) flavors.
  - Grain flavored nuggets have positive impact on sales with increase of 425 units.
  - Patty in Regular (+831) and Tex-Mex (+717) flavors are popular for sales in this region.
  - Sliced forms with Italian flavor are popular, with an increase in sales by 117 units.

- Pricing Strategy:
  - Lastly, increasing price per unit for meatball and ground forms negatively impacts sales by 1,125 and 853 units, respectively, while favoring less popular products such as non-meat, patty, and sliced.

Great Lakes

- Promotions: The most impactful promotions include features, display, and unit reductions. Within the Great Lakes region there were no promotions that negatively affected sales. Based on the model, display related promotions positively impact sales by 1102 units, feature promotions by 1000 units and unit reduction promotions by 863 units.
- Form: Like many other regions, the forms of "meatball" and "ground" had a positive impact on sales, but nuggets was also a popular form in this region. In the model, both ground and meatball forms had positive impacts on sales of 14,376 and 10,592 units respectively, while nuggets positively impact by 2046 units. The product form that negatively impacted sales in this region was sliced by –184 units, respectively.
- Flavor: The most popular flavors in the Great Lakes were grain (3437 units), fish (2343 units) and Asian (1123 units) flavors. Regular and TexMex flavor negatively impacted sales by -218 and -307 units, respectively.
- Interaction Effects: (Form x Flavor)
  - Positively impacting sales were Asian flavored filets (1268 units), Regular Patties (831 units).
  - The combinations that negatively impacted sales were regular or TexMex flavored nuggets.
- Pricing Strategy:
  - When looking for a pricing strategy, we found that increasing the price per unit would negatively impact sales for ground and meatball forms by 1556 and 1104 units, respectively. Outside of those two forms, poultry, seafood, fillet, nugget, patty, and sliced still had negative impacts on sales, but to a much less effect. On the other hand, there are minor benefits to the non-meat form.

Southeast

- Promotions: When looking at the past years in the markets, the Southeast region is among the highest tiers of developed markets, only falling a few points behind the Northeast and Midsouth. This does not mean progress is over yet since it has not reached the overdeveloped category yet. With this information, we have focused on finding the most important variables when trying to expand growth in this area. Our findings include the Promotion of Display Only, Feature and Display, Feature Only, and Unit Reductions Only, where these combined promotions have increased unit sales by over 16,000 sales units total. Leading these numbers are the Feature and Display category with an estimated 9,487-unit sales increase when using this type of promotion. As we can expect, no promotion hurt sales, but some performed better than others, leading us to advise Conagra to head their products using the Feature and Display promotion most of the time.

- <u>Form</u>: There is a clear pattern between regions as the Ground and Meatball forms had the greatest increase in sales predictions when available to the consumer along with Fillet and Patty forms also have a positive impact on sales units but at a lower level. The Ground meat form had an estimated increase of 24371 units and Meatball with an estimated 13762 units is almost incomparable to the rest of the forms which ranged from a negative impact to an increase in only a few hundred sales. The negatively impacting forms included Patties and non-meat which decreased estimated sales by 562 and -3389 units in the region.
- <u>Flavor</u>: The major impacts included Grain with an increase of 2824, Fish with an increase of 4428, Tex Mex with a decrease of 653, and Fresh with a decrease of 117. Based on this, it looks like Fish and Grain have their own biased reasons for their positive correlation to unit sales. Grain, being that vegans might just like the taste of foods that are not meat. The negatively impacted flavors are Fresh and Tex Mex had a combined negative impact of 1173.
- <u>Interaction Effect</u>: (Form x Flavor)
  - Regular fillets and Asian Fillet had increased sales units by 2418 and 1164 respectively with Grain and Spicy Nugget following with a positive impact of 1476 and 1016.
  - Although most of these had a positive impact, Regular Nugget, Tex Mex Nugget, and Asian Nugget have a combined estimated decrease in sales of around 1200 units.
- <u>Pricing Strategy</u>:
  - Increasing the price per unit for ground and meatball forms negatively impacts sales by 2913 and 1403 units respectively for each dollar increased in the price. Forms like poultry, seafood, fillet, nugget and sliced also had a decrease in unit sales when the price increased but at a much lower rate. However, non-meat and patty unit sales increased by 410 and 70 when the price of each unit increased by 1 dollar.

South Central

- <u>Promotions</u>: Promotions have a great and positive impact on sales in this region. When products are on Display Only, leading to an increase in sales of 842 units, and on Unit Reduction results in a 797-unit increase, followed by Feature Only and Feature and Display with 528 and 444 units increase, respectively.
- <u>Product Type</u>: The seafood and Nonmeat product types are the least popular, with negative sales in this region decrease by 1587 and 931 units, respectively.
- <u>Form</u>: Regarding product forms, ground products boost sales by 17,646 units, followed by meatballs (7,746). Conversely, sliced and patty forms decrease sales both by 159 units.
- <u>Flavor</u>: The most impactful flavors in this region include grain and Asian, with positive sales of 3,873 and 869. The least popular flavors here all have negative impact of sales, with regular decreasing sales by 76 units, fresh by 334 units, and breakfast by 64 units.
- <u>Type of substitute</u>: The most popular is Seafood with an increase in sales of 427 units, while chicken and pork decrease sales by 1050 and 1198 units, respectively.
- <u>Time Trend</u>: The year-over-year analysis shows that 2020 had much better sales than 2021 and 2022. However, sales went down substantially in 2023.
- <u>Interaction Effects</u>: (Form x Flavor)

- o Fillets performed well in both Regular +1417 and Asian +1121 flavors.
- o Nuggets and Grain, and Patty with Regular highly impact the sale with 619 and 716 units, respectively.
- o Nuggets with Regular flavor -262 and Spicy Patty -99 are hurting sales in this region.
- o Sliced forms either have no or negative impact, no matter the flavor, so it is not worth the resources to market it in this region.
- Pricing Strategy:
  - o Increasing the price per unit by $1 in the most impactful forms such as ground and meatball have a negative impact on the sales by 2006 and 802 units, respectively.
  - o Increasing the price per unit of products, such as nonmeat and seafood has a mildly positive impact on sales, by +88 and +355 units, respectively.

West

- Promotions: Promotions have a great and positive impact on sales in this region. When products are on Feature Only, leading to an increase in sales of 2716 units, followed by No Merch and Display only with 1513 and 1132 units increase, respectively.
- Product Type: The Nonmeat product types negatively affect sales in this region with a decrease in sales by 1003 units. The seafood is not worth the resource to market in this region.
- Form: Regarding product forms, Meatball products boost sales by 10,626 units, followed by Ground with 9,456 units. Conversely, sliced and patty forms decrease sales both by 842 and 1774 units, respectively.
- Flavor: grain products are outstanding from others seeing a 3,736-unit increase in sales. Italian and TexMex flavors negatively impact sales by 177 and 156 units, respectively.
- Type of substitute: Substitution with chicken, beef, and pork reduces sales by 1398, 909, and 266 units, respectively. The year-over-year analysis shows that 2020 and 2021 had much better sales than 2022 and 2023.
- Time Trend: The year-over-year analysis shows that 2020 and 2021 had much better sales, but 2022 was not much affected sale, so not worth considered. However, sales went down substantially in 2023.
- Interaction Effects: (Form x Flavor)
  - o Fillets performed well in Asian +1033 flavors, Patty with regular also boosts sale +204 units, and fillets with regular is not worth considered.
  - o Nuggets with Grain positively impacted the sale with 962 units.
  - o Nuggets with spicy flavor -713, nuggets with regular flavor -632, and nuggets with TexMex -506 are hurting sales in this region.
  - o Sliced forms with Italian so it is not worth the resources to market it in this region, while sliced with regular reduce sale by -444 units
- Pricing Strategy:
  - o Increasing the price per unit by $1 in the most impactful forms such as ground and meatball have a negative impact on the sales by 778 and 1263 units, respectively.
  - o Increasing the price per unit of products, such as patty and sliced has a mildly positive impact on sales, by +311 and +113 units, respectively.

Recommendations

Our recommendation based on model performance is to use region specific product mixes and marketing strategies to increase sales across the United States. Based on model results, the **top 2-3 recommendations for each region** are:

- California:
  1. Focus on display only promotions
  2. Maintain or expand Ground, Meatball Products
  3. Focus on expanding "Grain" based and "Asian" flavor products
- Great Lakes
  1. Focus on display or feature promotions at stores
  2. Region is sensitive to price for the most popular product forms.
  3. Avoid increasing prices for ground, meatball, and nugget product types.
- Midsouth
  1. Focus on display or price reductions promotions
  2. Maintain or expand Ground, Meatball products
  3. Increase "filet" sales by focusing on Asian and Regular flavors
- Northeast
  1. Region responds well to existing promotion strategy, limited pricing sensitivity around most popular forms (ground, meatball, nugget)
  2. Reduce patty product types as these negatively impact sales.
  3. Increase "grain" type flavors to positively impact sales
- Plains
  1. Focus on display or feature promotions and price reductions
  2. Limit sliced and patty type products as these negatively impact sales
  3. Reduce or eliminate flavor varieties Italian, TexMex, and Fresh as these have poor sales
- Southeast
  1. Focus on Feature and Display promotions, regional sales respond positively to this approach
  2. Region responds well to "Fish" related flavors well, may be a good market to test sales response.
  3. The region is price sensitive. Avoid increasing price per unit in this region.
- South Central
  1. Eliminate "seafood" product types as they negatively impact sales
  2. Potentially increase sales of patty products by focusing on Regular and TexMex flavors
- West
  1. Focus on feature promotions
  2. Reduce or eliminate patty type products in this region
  3. Maintain ground, meatball, and filet type products

Conclusion

Gardein is well positioned to increase their market share across the US with a few well-placed changes. As more individuals try meat substitutes, there are opportunities to add more consumers using existing regional preferences for promotions, product types and flavors. The regression models provide useful insights into these regional variances, enabling targeted strategies to boost sales. Promotions play a crucial role in all regions and have consistently positive impacts across the board. The ground and meatball product forms show strong sales growth in most regions, while certain flavors like grain and Asian also contribute to sales growth. Pricing strategies vary by region, with price sensitivity most notable in the Great Lakes and Southeast regions, necessitating a cautious approach when increasing per-unit prices. California and West regions, however, have shown resilience to varying pricing strategies, shifting the focus toward feature and display promotions to drive sales. Overall, this regionalized analysis underlines the importance of tailored marketing and product mixes to optimize sales across the United States. We expect that with these changes in place, Gardein will not only increase their sales, but overtake their competitors in the nationwide market.

References

Morris, M. (2021, April 28). *The most popular eating habits across America*. Eat This Not That.
https://www.eatthis.com/regional-eating-habits/

Wunsch, N.-G. (2024, March 4). *Top motivations for Veganuary 2023*. Statista.
https://www.statista.com/statistics/1264382/top-motivations-for-veganuary/

Appendix:

Heatmaps for Collinearity
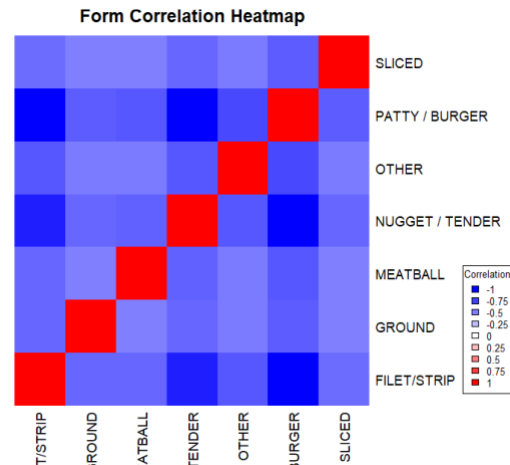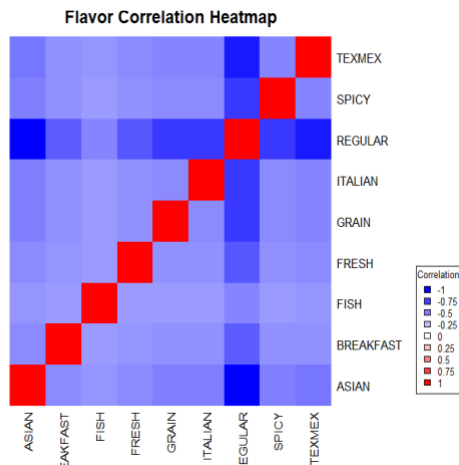
Regression Results by Region

California:

Plot of residuals:
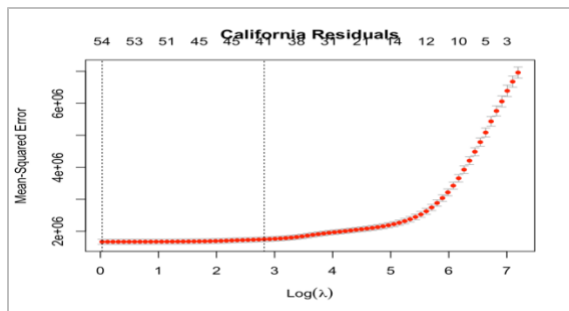
Optimal lambda: 1.030875

Min (MSE) = 1671105

Coefficients:

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(Intercept)                 .
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ppuFeatNDisp             432.358452
ppuFeatOnly              302.711805
ppuNoMerch               454.049762
ppuUnitRedOnly           955.406007
poulDum                  370.865034
nonMeatDum               -25.471252
seaDum                      .
filetDum                 883.019169
grndDum                 9914.130499
meatballDum             5465.953298
nuggetDum                287.823563
pattyDum                -573.324076
slicedDum               -285.214497
flvAsianDum              870.603941
flvBfstDum              -238.280167
flvFishnDum                 .
flvFreshnDum            -326.097869
flvGrainDum             6732.324377
flvItlnDum              -401.622813
flvRglrDum                  .
flvSpicyDum                 .
flvTxMxDum                  .
tosBeefDum              -407.521591
tosChkDum              -2520.548082
tosPrkDum                145.215661
tosSfDum                    .
tosSsgDUm                 76.736372
tosUnkDum                   .
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y21                     1069.145044
y22                       54.996442
y23                     -595.475869
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price_per_unit:ppuUnitRedOnly    -62.291387
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nuggetDum:flvGrainDum            190.473607
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nuggetDum:flvAsianDum              1.602884
pattyDum:flvRglrDum              193.926926
pattyDum:flvTxMxDum             -122.060071
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pattyDum:flvSpicyDum             171.851326
pattyDum:flvFreshnDum            -54.332456
pattyDum:flvBfstDum             -158.219001
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slicedDum:flvRglrDum              -7.477985
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price_per_unit:nonMeatDum        -78.253797
price_per_unit:seaDum            100.154380
price_per_unit:filetDum             .
price_per_unit:grndDum         -1011.206425
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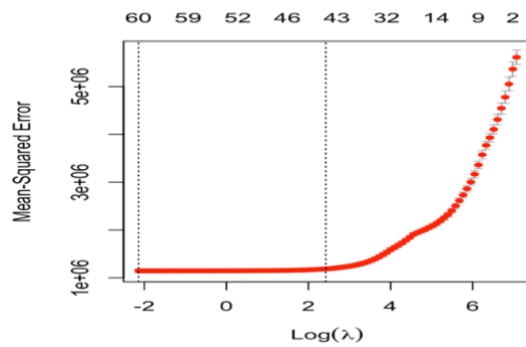
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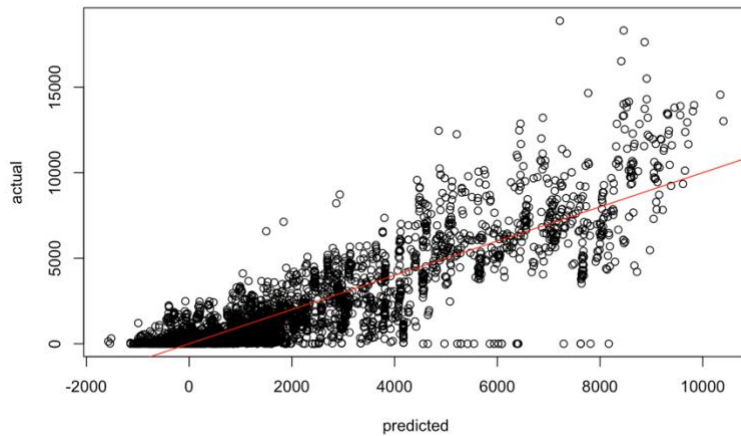
R-sq: 0.7531796
Adj R-sq: 0.7458138

Great Lakes:

Plot of residuals:

Optimal lambda: 0. 1178041

MSE min = 1146096

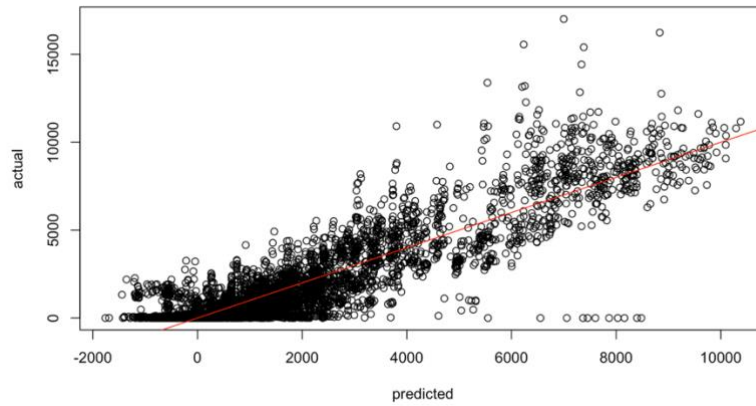AIC: -32548402279

Coefficients:

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ppuFeatOnly           1000.9855364
ppuNoMerch             993.2561225
ppuUnitRedOnly         863.9126998
poulDum                822.3401440
nonMeatDum            -848.1842570
seaDum                  12.1101354
filetDum               271.3693325
grndDum              14376.9155957
meatballDum          10592.7286791
nuggetDum             2046.8177410
pattyDum                23.2840652
slicedDum             -184.9696183
flvAsianDum           1123.0539430
flvBfstDum              94.6035371
flvFishnDum           2343.2689849
flvFreshnDum                    .
flvGrainDum           3437.4321363
flvItlnDum               0.1908828
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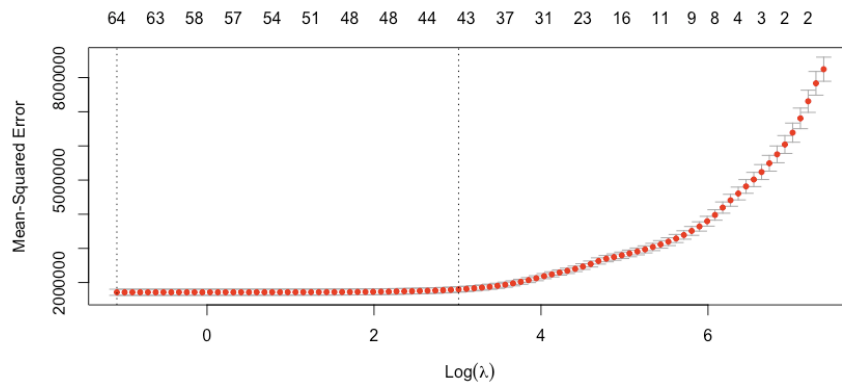
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R-sq: 0. 7994277

Adj R-sq: 0.7976686

Midsouth:

Plot of lambda:

Optimal lambda: 0.4089315
MSE min = 1715377

Coefficients:

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flvSpicyDum                          .
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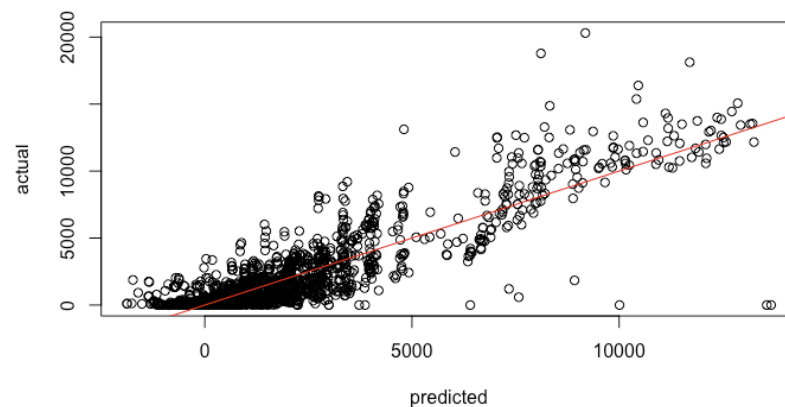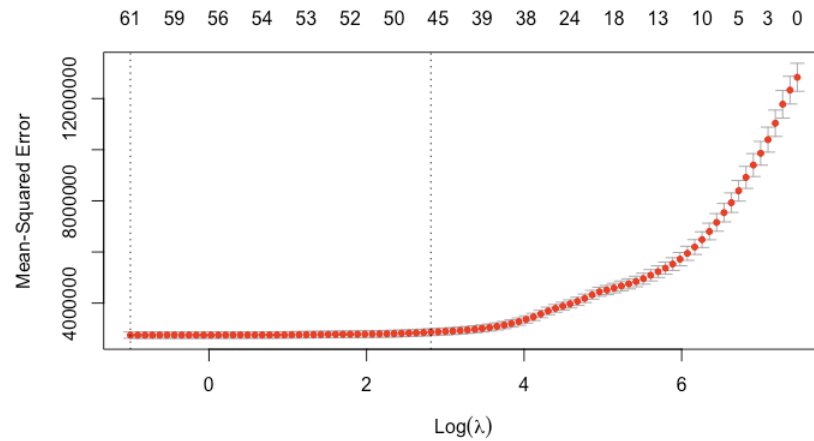
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Predicted vs actuals plot:

R-sq: 0.7902279

Adj R-sq: 0.7878414

Northeast:

Optimal lambda: 1.125676

Plot of residuals:

MSE min = 2758112

Coefficients:

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ppuNoMerch	4110.292150	price_per_unit:ppuFeatOnly	-178.800312
ppuUnitRedOnly	1462.623230	price_per_unit:ppuNoMerch	-348.246436
poulDum	1152.785925	price_per_unit:ppuUnitRedOnly	-110.973765
nonMeatDum	-1610.939242	filetDum:flvRglrDum	.
seaDum	.	filetDum:flvAsianDum	1062.038923
filetDum	822.376589	nuggetDum:flvRglrDum	.
grndDum	20291.803928	nuggetDum:flvTxMxDum	-420.356982
meatballDum	12576.698138	nuggetDum:flvGrainDum	1421.280026
nuggetDum	1352.324462	nuggetDum:flvSpicyDum	.
pattyDum	-1347.870334	nuggetDum:flvAsianDum	16.794388
slicedDum	.	pattyDum:flvRglrDum	367.443566
flvAsianDum	66.782715	pattyDum:flvTxMxDum	.
flvBfstDum	-215.920951	pattyDum:flvItlnDum	-784.053802
flvFishnDum	29.611571	pattyDum:flvSpicyDum	-611.484100
flvFreshnDum	-235.575414	pattyDum:flvFreshnDum	-150.101842
flvGrainDum	6635.393216	pattyDum:flvBfstDum	-591.504401
flvItlnDum	.	slicedDum:flvItlnDum	887.342221
flvRglrDum	.	slicedDum:flvRglrDum	-716.816124
flvSpicyDum	-126.503170	price_per_unit:poulDum	-130.002194
flvTxMxDum	.	price_per_unit:nonMeatDum	184.614793
tosBeefDum	-706.541457	price_per_unit:seaDum	28.206240
tosChkDum	-1511.236154	price_per_unit:filetDum	-11.128701
tosPrkDum	195.797666	price_per_unit:grndDum	-2167.455398
tosSfDum	-274.885520	price_per_unit:meatballDum	-1039.424202
tosSsgDUm	372.703193	price_per_unit:nuggetDum	-417.359040
tosUnkDum	.	price_per_unit:pattyDum	213.180748
y20	1352.730940	price_per_unit:slicedDum	.
y21	47.730967		
y22	-184.794032		
y23	-465.765922		

AIC: - 84168464045

Predicted y plot:
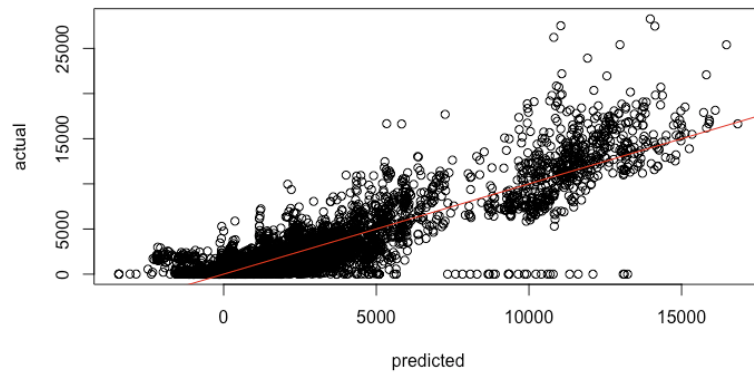
R-sq: 0.788743
Adj R-sq: 0.787309

Plains:

Optimal lambda: 0.2355

Plot of residuals:
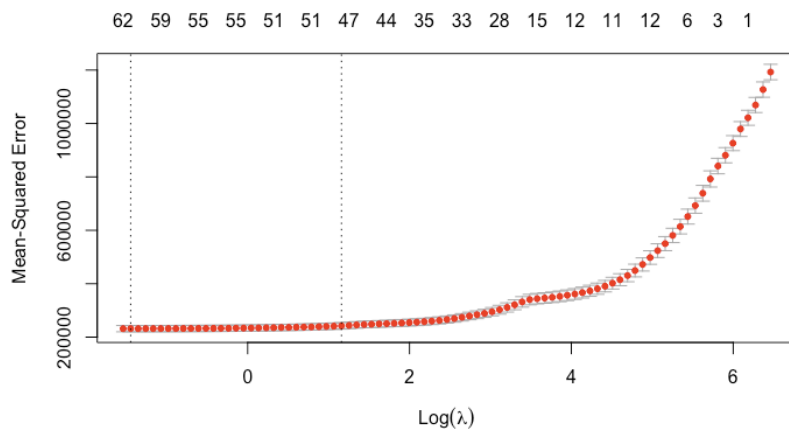
MSE min = 231701.1

Coefficients:

Coefficient	Value	Coefficient	Value
(Intercept)	-727.5138148	price_per_unit:y20	-90.3527474
(Intercept)	.	price_per_unit:y21	-19.0387595
price_per_unit	76.0665706	price_per_unit:y22	13.4960691
ppuDispOnly	649.9211173	price_per_unit:y23	34.5450283
ppuFeatNDisp	-63.4104009	price_per_unit:ppuDispOnly	-50.3663131
ppuFeatOnly	573.4949135	price_per_unit:ppuFeatNDisp	41.5940276
ppuNoMerch	311.1687582	price_per_unit:ppuFeatOnly	-73.6798380
ppuUnitRedOnly	760.5054831	price_per_unit:ppuNoMerch	14.9092339
poulDum	504.5186087	price_per_unit:ppuUnitRedOnly	-80.9997909
nonMeatDum	-515.4349074	filetDum:flvRglrDum	538.5062262
seaDum	308.6990741	filetDum:flvAsianDum	626.2876823
filetDum	308.0003064	nuggetDum:flvRglrDum	-34.9527590
grndDum	7382.0915110	nuggetDum:flvTxMxDum	.
meatballDum	6744.7480493	nuggetDum:flvGrainDum	346.5435750
nuggetDum	-49.2158604	nuggetDum:flvSpicyDum	54.3607958
pattyDum	.	nuggetDum:flvAsianDum	.
slicedDum	-259.7990261	pattyDum:flvRglrDum	12.9216360
flvAsianDum	148.5527086	pattyDum:flvTxMxDum	-9.8101453
flvBfstDum	-3.1547428	pattyDum:flvItlnDum	-59.6225159
flvFishnDum	.	pattyDum:flvSpicyDum	.
flvFreshnDum	-165.2004877	pattyDum:flvFreshnDum	-59.1470666
flvGrainDum	1240.2760472	pattyDum:flvBfstDum	-0.2449697
flvItlnDum	-211.9178638	slicedDum:flvItlnDum	.
flvRglrDum	.	slicedDum:flvRglrDum	-0.5177468
flvSpicyDum	80.5942574	price_per_unit:poulDum	-96.2297057
flvTxMxDum	-159.6077591	price_per_unit:nonMeatDum	45.5089109
tosBeefDum	-164.5883581	price_per_unit:seaDum	-103.2965056
tosChkDum	-457.7514052	price_per_unit:filetDum	-101.3498511
tosPrkDum	-89.2176695	price_per_unit:grndDum	-852.4927906
tosSfDum	229.9853941	price_per_unit:meatballDum	-1118.5765739
tosSsgDUm	-23.7635408	price_per_unit:nuggetDum	-1.4029853
tosUnkDum	81.9467974	price_per_unit:pattyDum	15.7777323
y20	456.5048339	price_per_unit:slicedDum	45.3251830
y21	-92.8118598		
y22	-232.2776113		
y23	-452.8024374		

AIC: - 1618439122

Predicted y plot:
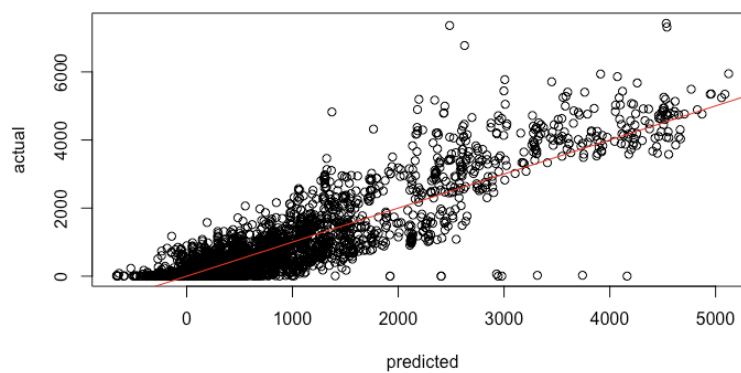
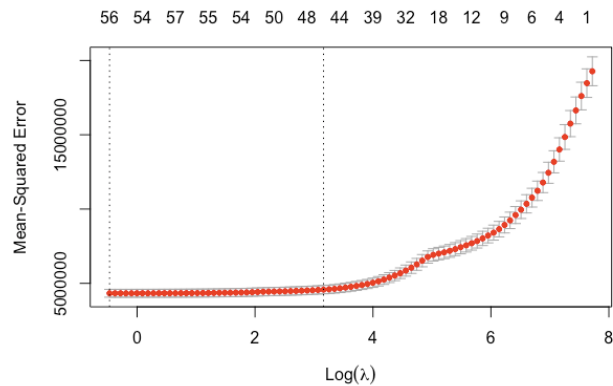R-sq: 0. 8031615

Adj R-sq: 0.7966401

Southeast:

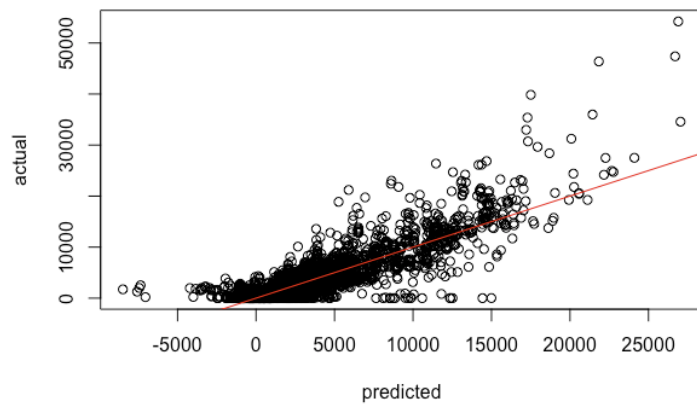Optimal lambda: 0.6880084

Plot of lambda:

MSE min = 4375270

Coefficients:

|			
(Intercept)	-2952.692573	price_per_unit:y20	-97.259965
(Intercept)	.	price_per_unit:y21	-47.558270
price_per_unit	348.386692	price_per_unit:y22	9.138272
ppuDispOnly	3054.602400	price_per_unit:y23	126.998673
ppuFeatNDisp	9487.912871	price_per_unit:ppuDispOnly	-318.606057
ppuFeatOnly	2714.086081	price_per_unit:ppuFeatNDisp	-1383.264114
ppuNoMerch	2690.730816	price_per_unit:ppuFeatOnly	-352.126360
ppuUnitRedOnly	2398.693400	price_per_unit:ppuNoMerch	-330.076938
poulDum	961.044585	price_per_unit:ppuUnitRedOnly	-198.294512
nonMeatDum	-3389.679173	filetDum:flvRglrDum	2418.606719
seaDum	899.836523	filetDum:flvAsianDum	1164.967174
filetDum	2138.395322	nuggetDum:flvRglrDum	-339.145660
grndDum	24361.601367	nuggetDum:flvTxMxDum	-335.447263
meatballDum	13762.484279	nuggetDum:flvGrainDum	1476.353563
nuggetDum	960.769513	nuggetDum:flvSpicyDum	1016.415763
pattyDum	-562.877718	nuggetDum:flvAsianDum	-499.490533
slicedDum	.	pattyDum:flvRglrDum	702.145912
flvAsianDum	318.179275	pattyDum:flvTxMxDum	597.817757
flvBfstDum	-5.832444	pattyDum:flvItlnDum	-733.864038
flvFishnDum	4428.520816	pattyDum:flvSpicyDum	-33.795674
flvFreshnDum	-117.390859	pattyDum:flvFreshnDum	-440.108955
flvGrainDum	2824.196582	pattyDum:flvBfstDum	.
flvItlnDum	.	slicedDum:flvItlnDum	558.350649
flvRglrDum	-1.256927	slicedDum:flvRglrDum	-3.102481
flvSpicyDum	103.909879	price_per_unit:poulDum	-154.917357
flvTxMxDum	-653.155240	price_per_unit:nonMeatDum	410.497625
tosBeefDum	-455.869155	price_per_unit:seaDum	-278.353349
tosChkDum	102.282946	price_per_unit:filetDum	-492.743919
tosPrkDum	-34.322025	price_per_unit:grndDum	-2913.168321
tosSfDum	204.387797	price_per_unit:meatballDum	-1403.498957
tosSsgDUm	-65.700829	price_per_unit:nuggetDum	-263.527085
tosUnkDum	8.990373	price_per_unit:pattyDum	70.041710
y20	1226.861878	price_per_unit:slicedDum	-25.447802
y21	360.488237		
y22	155.090664		
y23	-680.624730		

AIC: - 28210857582

Predicted y plot:

R-sq: 0.7615009

Adj R-sq: 0.7542289

South Central:

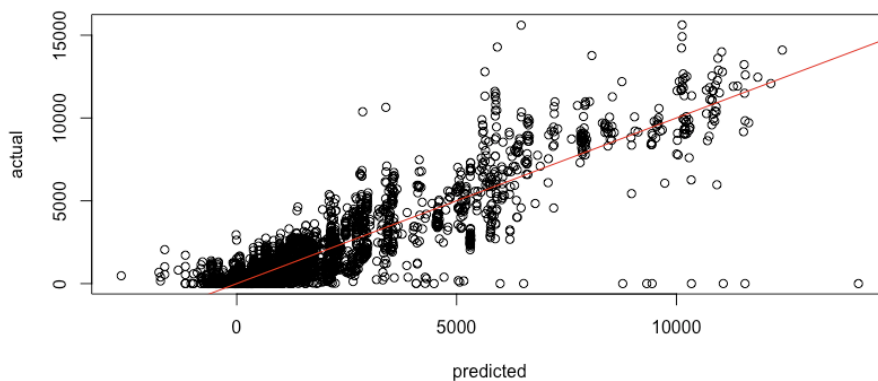Optimal lambda: 0.2657785

Plot of lambda:
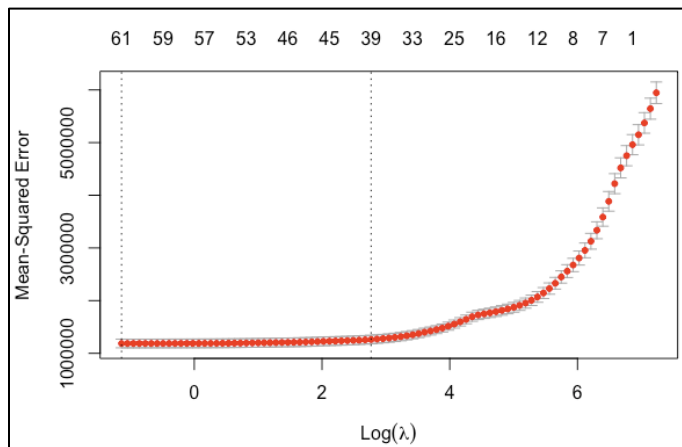
MSE min = 1186494

Coefficients:

|	s0		
(Intercept)	-937.3977142	price_per_unit:y20	-291.3636792
(Intercept)	.	price_per_unit:y21	-47.8243279
price_per_unit	192.2088647	price_per_unit:y22	-15.5083842
ppuDispOnly	842.5906590	price_per_unit:y23	87.3702300
ppuFeatNDisp	444.6124426	price_per_unit:ppuDispOnly	-33.4457441
ppuFeatOnly	528.3885130	price_per_unit:ppuFeatNDisp	53.5465752
ppuNoMerch	332.8451990	price_per_unit:ppuFeatOnly	3.9990469
ppuUnitRedOnly	797.4673788	price_per_unit:ppuNoMerch	-47.7046966
poulDum	-35.3814259	price_per_unit:ppuUnitRedOnly	-63.3875245
nonMeatDum	-931.6467791	filetDum:flvRglrDum	1417.5002344
seaDum	-1587.0097174	filetDum:flvAsianDum	1121.7355152
filetDum	1173.6634135	nuggetDum:flvRglrDum	-262.1470055
grndDum	17646.7582359	nuggetDum:flvTxMxDum	-11.6171804
meatballDum	7746.3832843	nuggetDum:flvGrainDum	619.7572206
nuggetDum	1319.2126515	nuggetDum:flvSpicyDum	290.8484465
pattyDum	-159.3684768	nuggetDum:flvAsianDum	.
slicedDum	-159.1947386	pattyDum:flvRglrDum	716.2504101
flvAsianDum	869.2565904	pattyDum:flvTxMxDum	274.9457403
flvBfstDum	-64.1071652	pattyDum:flvItlnDum	75.1016568
flvFishnDum	.	pattyDum:flvSpicyDum	-99.1498938
flvFreshnDum	-334.1791449	pattyDum:flvFreshnDum	-0.9092985
flvGrainDum	3873.0621748	pattyDum:flvBfstDum	.
flvItlnDum	.	slicedDum:flvItlnDum	.
flvRglrDum	-76.1205702	slicedDum:flvRglrDum	.
flvSpicyDum	.	price_per_unit:poulDum	-61.6188899
flvTxMxDum	.	price_per_unit:nonMeatDum	88.2798166
tosBeefDum	-556.0900402	price_per_unit:seaDum	355.1759594
tosChkDum	-1050.5094200	price_per_unit:filetDum	-322.9224702
tosPrkDum	-1198.1958416	price_per_unit:grndDum	-2006.9350115
tosSfDum	427.1845197	price_per_unit:meatballDum	-802.0377105
tosSsgDUm	-1.5000784	price_per_unit:nuggetDum	-219.0922171
tosUnkDum	9.5153380	price_per_unit:pattyDum	-40.4474765
y20	1919.5979795	price_per_unit:slicedDum	.
y21	354.1996466		
y22	179.0525225		
y23	-778.0352621		

AIC: - 8744449900

Predicted y plot:

R-sq: 0.7984904

Adj R-sq: 0.7921246
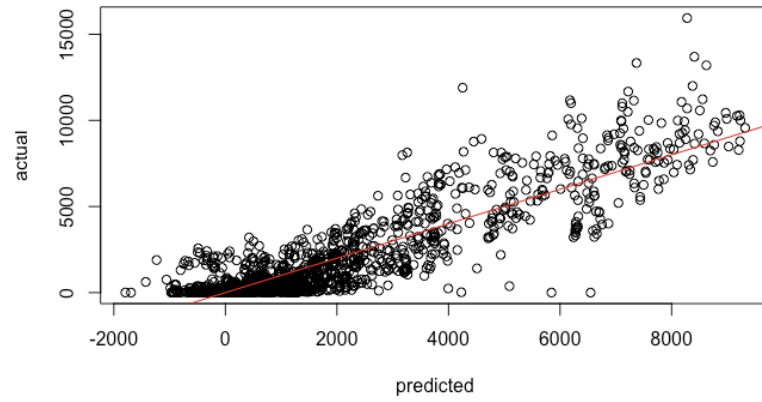
West:

Optimal lambda: 0.6867049

Plot of lambda:
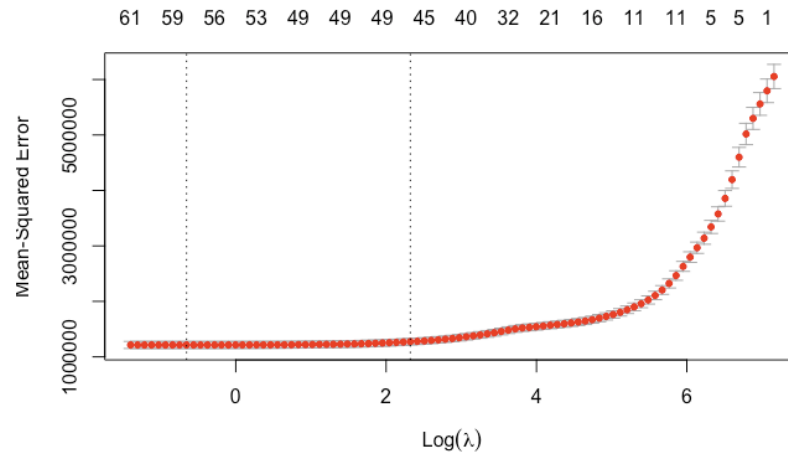
MSE min = 1219919

Coefficients:

	s0		
(Intercept)	-547.5464186	price_per_unit:y20	-293.1644807
(Intercept)	.	price_per_unit:y21	-125.9548579
price_per_unit	96.1837944	price_per_unit:y22	-7.6329319
ppuDispOnly	1132.1773636	price_per_unit:y23	47.5859211
ppuFeatNDisp	72.3885074	price_per_unit:ppuDispOnly	-37.0035941
ppuFeatOnly	2716.5662095	price_per_unit:ppuFeatNDisp	42.5469806
ppuNoMerch	1513.9778386	price_per_unit:ppuFeatOnly	-423.4562257
ppuUnitRedOnly	829.6718837	price_per_unit:ppuNoMerch	-252.4699402
poulDum	21.1254135	price_per_unit:ppuUnitRedOnly	-69.8022804
nonMeatDum	-1003.5573310	filetDum:flvRglrDum	.
seaDum	.	filetDum:flvAsianDum	1033.3689902
filetDum	628.3698345	nuggetDum:flvRglrDum	-632.2445161
grndDum	9456.7069729	nuggetDum:flvTxMxDum	-506.1803254
meatballDum	10626.0178407	nuggetDum:flvGrainDum	962.5058866
nuggetDum	-0.1849272	nuggetDum:flvSpicyDum	-713.3372689
pattyDum	-1774.3837503	nuggetDum:flvAsianDum	-157.0114732
slicedDum	-842.4750720	pattyDum:flvRglrDum	204.3515262
flvAsianDum	.	pattyDum:flvTxMxDum	.
flvBfstDum	-10.7319697	pattyDum:flvItlnDum	-222.8003687
flvFishnDum	.	pattyDum:flvSpicyDum	-302.2880978
flvFreshnDum	-46.4408343	pattyDum:flvFreshnDum	-315.0609021
flvGrainDum	3736.0301296	pattyDum:flvBfstDum	-448.1525274
flvItlnDum	-177.4422223	slicedDum:flvItlnDum	.
flvRglrDum	20.2783672	slicedDum:flvRglrDum	-444.3701419
flvSpicyDum	-1.3975219	price_per_unit:poulDum	.
flvTxMxDum	-156.4639944	price_per_unit:nonMeatDum	93.2569164
tosBeefDum	-909.3579867	price_per_unit:seaDum	-56.6260577
tosChkDum	-1398.7788607	price_per_unit:filetDum	53.8808086
tosPrkDum	-266.3251504	price_per_unit:grndDum	-778.4499779
tosSfDum	.	price_per_unit:meatballDum	-1263.2541726
tosSsgDUm	129.5483389	price_per_unit:nuggetDum	49.9720861
tosUnkDum	.	price_per_unit:pattyDum	311.5699565
y20	1705.8744232	price_per_unit:slicedDum	113.7584968
y21	663.1676945		
y22	.		
y23	-444.0032241		

AIC: - 22076947819

Predicted y plot:

R-sq: 0.8036828

Adj R-sq: 0.8011783