

BA 875

Operations and Supply Chain Analytics

Homework Assignment 1 (Due 3/29)

Deliverable: Submit your homework assignment as a single Python Notebook only and clearly state your answer to each component of a question. Ensure to save Notebook with output shown. The delivery requirement has been stated here and in the HW submission portal. *You shall receive a 10 point reduction in grade if you do not submit in the format specified.*

Forecasting Price Changes & Promotions

Dataset: jeans_data

You are given the same dataset of prices for a pair of jeans from a medium sized fashion retailer in the southeast USA and their corresponding sales. The data is reported on a week-to-week basis. In addition to price as an input, you are also given a binary indicator variable (se_indicator) specifying whether a given week occurred during a special event (e.g., Christmas).

In the weekly historical data, there was an original retail price for the sales offered (\$135) as well as two promotional prices: 15% off (\$101.25) and 25% off (\$114.75). In a previous analysis (see in-class example), the two 15% off and 25% off promotions that were already tested in stores was examined to see if they had a statistically significant effect. This was done by specifying the two promo prices as dummy variables, as follows:

$$sales = \beta_0 + \beta_1 * promotion114 + \beta_2 * promotion101 + \beta_3 * se_indicator + \epsilon$$

The above regression is great for retrospectively evaluating the two promotions. But it is not prescriptive. We are interested in giving the retailer a sense of its estimated sales if it decided to offer a new promo to predict sales for a week in the future, i.e., they want you to predict the sales for a future week given you offer **promo (P): “\$25 Off” (not 25% off) promotion specifically during a special event period.**

As you are interested in predicting future sales from a new type of promotion, you no longer need to examine the previous promotions separately (i.e., *no longer need the two dummy variables*); you simply need to include “price” as the variable capturing price levels by week.

Based on this information, reporting the following back to the fashion retailer:

- a. Model I: Price (in \$) and special event indicator as an independent variable
 - Calculate the predicted sales from **promo (P)** when directly including price and special event indicator as independent variables into a regression model
 - Make sure to interpret your results, including the regression estimation as well as the meaning of your findings based on the prediction for promo (P) - simply showing output of running code does not suffice, provide an interpretation in your own words!

- b. Model II: Price (as a % discount off original price) and special event indicator as an independent variable
- Calculate the predicted sales *promo (P)* when directly including price and special event indicator as before, but this time replace price with a % discount variable, and include discount as an independent variable into a regression model
 - Make sure to interpret your results, including the regression estimation as well as the meaning of your findings based on the prediction for promo (P) - simply showing output of running code does not suffice, provide an interpretation in your own words!