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Business Forecasting

Dummy Variable Regression

Regression in Time Series methods

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Regression is a useful tool to estimate models where the target variable (Y) can be explained by "causal" independent variables (X)

eg Sales (Y) explained by **Price**, **Promotional Spend**, **Income**, **Interest rates**, **Competitors** (X's)

Regression can also be used to estimate models more indicative of **time series models**

Quasi- explanatory variables (time, seasonal dummies, lagged dependent variables) can be used instead of regular explanatory variables.

Trend Extrapolations

Trend extrapolation based on trend equation

$$Y_t = f(\text{time})$$

For a linear trend → $Y_t = \beta_o + \beta_1 * t$

The time index "t" acts as a quasi explanatory variable to help explain/forecast Y_t with regression used to estimate β_o , β_1

Estimated equation $(Y_t = b_o + b_1 * t)$ used to forecast Y_t based on future value of time index

Often used as quick way of **generating forecasts of independent variables** needed in regression forecasts of the target variable.

Explanatory and Dummy Variables

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It is possible to **utilise seasonal variables** in typical "causal" regression models.

The seasonal dummies can account for **seasonal impacts** not explained by the independent variables.

Interpretation and forecasting as in previous examples

Example:

Y = Pie Sales

X_1 = Price

$$\hat{Y} = b_0 + b_1 X_1 + b_2 X_2$$

X_2 = Holiday (X_2 = 1 if a holiday occurred during the week and X_2 = 0 if there was no holiday that week)

Combining Explanatory & Dummies

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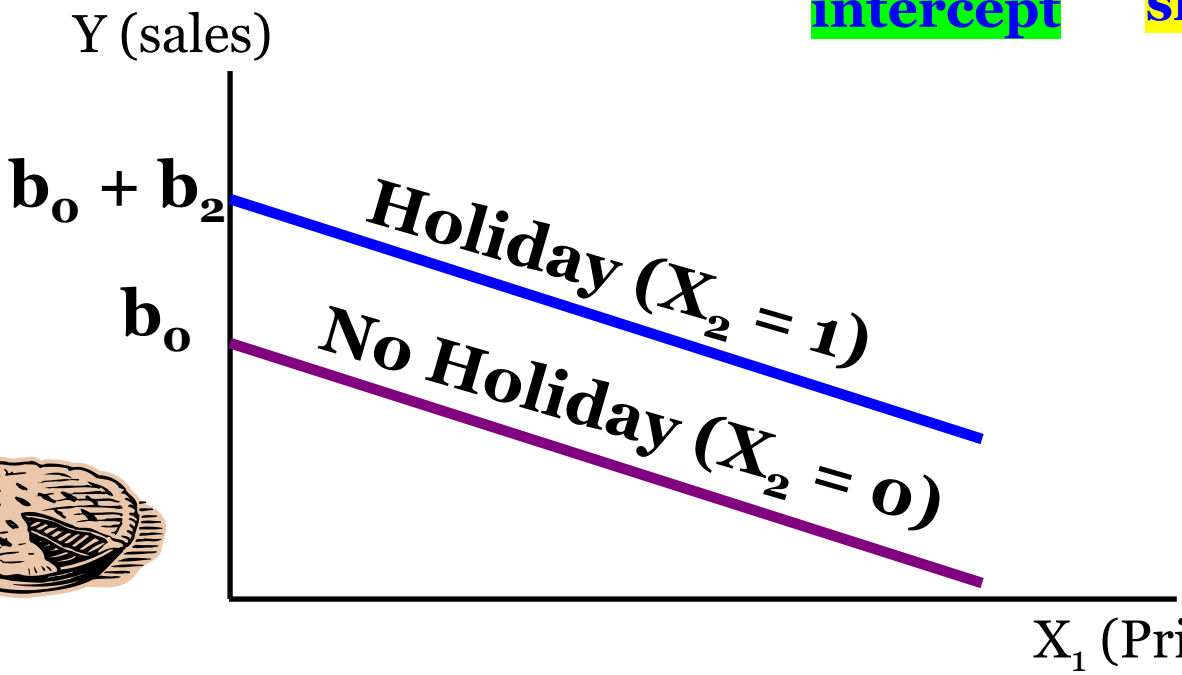
$\hat{Y} = b_0 + b_1X_1 + b_2(1) = (b_0 + b_2) + b_1X_1$	**Holiday**
$\hat{Y} = b_0 + b_1X_1 + b_2(0) = b_0 + b_1X_1$	**No Holiday**

Different intercept

Same slope



If $H_0: \beta_2 = 0$ is rejected, then "Holiday" has a significant effect on pie sales

Interpreting the Dummy Coefficient

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$$\widehat{Sales} = 300 - 30(Price) + 15(Holiday)$$

Sales: Number of pies sold per week

Price: Pie price in $

Holiday:
- 1 If a holiday occurred during the week
- 0 If no holiday occurred

$b_2 = 15$ >> On average, sales were 15 pies greater in weeks with a holiday than in weeks without a holiday, given the same price