

# Discrete Response Model

## Lecture 2

---

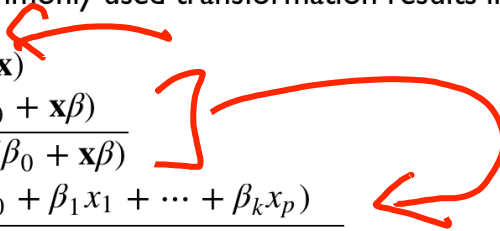
**[datascience@berkeley](mailto:datascience@berkeley)**

# Binomial Logistic Regression Model

# The Logit Transformation and the Logistic Curve


# The Most Common Transformation

- There are a number of solutions to prevent  $i$  from being outside the range of a probability.
- Most solutions rely on non-linear transformations to prevent these types of problems from occurring.
- The most commonly used transformation results in the logistic regression model

$$\begin{aligned}
 \pi_i &= P(y = 1 | \mathbf{x}) \\
 &= \frac{\exp(\beta_0 + \mathbf{x}\beta)}{1 + \exp(\beta_0 + \mathbf{x}\beta)} \\
 &= \frac{\exp(\beta_0 + \beta_1 x_1 + \dots + \beta_k x_p)}{1 + \exp(\beta_0 + \beta_1 x_1 + \dots + \beta_p x_p)}
 \end{aligned}$$


- Note that  $\exp(\beta_0 + \mathbf{x}\beta) > 0$  so that the numerator is always less than the denominator, forcing the response probability to go fall within the zero and one range:  $0 < \pi_i < 1$

The Logistic regression can be written as log(Odd Ratio):

$$\log\left(\frac{\pi_i}{1 - \pi_i}\right) = \beta_0 + \mathbf{x}_i\beta$$


# Berkeley

SCHOOL OF  
INFORMATION