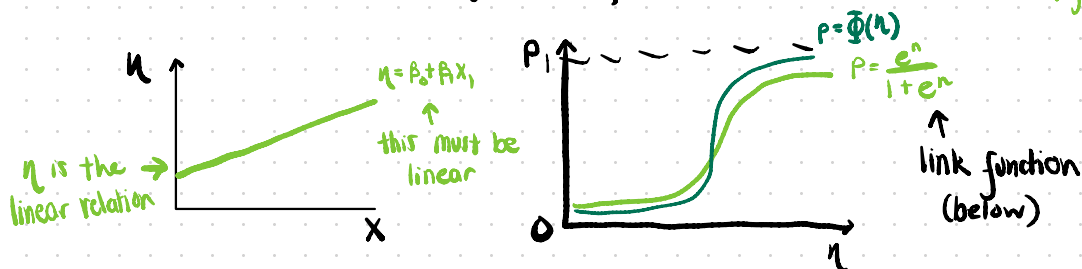


# WEEK THREE: BINARY RESPONSE

## Transformation of Y

- Lose assumption of  $Y \sim N(\beta X, \sigma^2)$ , now  $Y \sim \text{Bernoulli}(p)$
- Want to keep some form of linearity with  $\eta = \beta_0 + \beta_1 X_1 + \dots$  ↑ non-linear transform



## Link function

- logit link function  $p = \frac{e^\eta}{1 + e^\eta}$
- Probit link function  $p = \Phi(\eta) \leftarrow \text{prob from normal dist}$

## Odds Ratio & Interpretations

- The coefficients in the logit output are not directly interpretable
- In a linear regression:

$$y = \beta_0 + \beta_1 X_1 + \dots + \beta_p X_p + \epsilon$$

$\beta$  is the average change in  $Y$  due to a unit increase in  $X$  holding other  $X$  constant.

In a logit regression

$$\text{odds} = \frac{p}{1-p} = e^{\beta_0} e^{\beta_1 X_1} \dots + \epsilon$$

A unit increase in  $X$  increases the log odds of success by a factor of  $e^{\beta_1}$

$$\text{odds ratio} = 100 \times (e^{\beta_1} - 1)$$

The odds of  $Y$  change by [odds ratio] with each unit increase in  $X$  holding all other  $X$  constant.