

deterministic model

$$\mu_i = \beta_0 + (\overbrace{\beta_1}^{\text{time slope}} + \beta_1 x_{1,i} + \beta_2 x_{2,i})t$$

or, equivalently

$$\begin{pmatrix} \mu_{1,t} \\ \mu_{2,t} \\ \mu_{3,t} \\ \vdots \\ \vdots \\ \mu_{n,t} \end{pmatrix} = \beta_0 + \begin{pmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ 1 & 1 & 1 \\ \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots \\ 1 & 0 & 1 \end{pmatrix} \times \begin{pmatrix} \beta_1 \\ \beta_2 \\ \beta_2 \end{pmatrix} \times t$$

$$\boldsymbol{\mu} = \beta_0 + \mathbf{X}\boldsymbol{\beta}$$

likelihood

$$y_i \sim [y_i|\mu_i, \sigma^2]$$

e.g.,

$$y_i \sim \text{normal}(\mu_i, \sigma^2)$$