**4.3.5 Probit regression** 

$$f(x) = rac{1}{\sqrt{2\pi\sigma^2}} \exp{-rac{(x-\mu)^2}{2\sigma^3}}$$
 $\Phi(a) = \int_{-\infty}^a \mathcal{N}( heta \mid 0, 1) \mathrm{d} heta$ 
 $\mathrm{erf}(a) = rac{2}{\sqrt{\pi}} \int_0^a \exp{\left(- heta^2/2\right)} \, \mathrm{d} heta$ 
 $\Phi(a) = rac{1}{2} \left\{ 1 + rac{1}{\sqrt{2}} \operatorname{erf}(a) 
ight\}$ 
 $p(t \mid \mathbf{x}) = (1 - \epsilon)\sigma(\mathbf{x}) + \epsilon(1 - \sigma(\mathbf{x}))$ 
 $= \epsilon + (1 - 2\epsilon)\sigma(\mathbf{x})$ 

## 4.3.6 Canonical link functions

$$egin{aligned} p(t \mid \eta, s) &= rac{1}{s} h\left(rac{t}{s}
ight) g(\eta) \exp\left\{rac{\eta t}{s}
ight\} \ y &\equiv \mathbb{E}[t \mid \eta] = -srac{d}{d\eta} \ln g(\eta) \ y &= f\left(\mathbf{w}^{\mathrm{T}} oldsymbol{\phi}
ight) \ \ln p(\mathbf{t} \mid \eta, s) &= \sum_{n=1}^{N} \ln p\left(t_n \mid \eta, s
ight) = \sum_{n=1}^{N} \left\{ \ln g\left(\eta_n
ight) + rac{\eta_n t_n}{s} 
ight\} + \mathrm{\,const\,} \end{aligned}$$

$$egin{aligned} 
abla_{\mathbf{w}} \ln p(\mathbf{t} \mid \eta, s) &= \sum_{n=1}^{N} \left\{ rac{d}{d\eta_n} \ln g\left(\eta_n
ight) + rac{t_n}{s} 
ight\} rac{d\eta_n}{dy_n} rac{dy_n}{da_n} 
abla a_n \end{aligned} \ &= \sum_{n=1}^{N} rac{1}{s} \left\{ t_n - y_n 
ight\} \psi'\left(y_n
ight) f'\left(a_n
ight) oldsymbol{\phi}_n \end{aligned} \ f^{-1}(y) &= \psi(y) \end{aligned} \ 
abla Diffuse  $\nabla \ln E(\mathbf{w}) = rac{1}{s} \sum_{n=1}^{N} \left\{ y_n - t_n 
ight\} \phi_n$$$

aaa

a