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Binary dep. var., LPM, Logit Model, Odd Ratio, Marginal Effect, predicted probability, Pseudo-R^2, Maximum Likelihood

Saturated Model: (Ex, $y = \alpha + \beta\, single + \gamma\, male + \delta(single \times male) + u$)
We have a paramater for Difference-in-Difference
⊕ Parallel Trend Assumption ?

Considering binary variables as dependent variables
i.e. $Vote_i = \alpha_0 + \alpha_1 Income_i + u$

LPM: Linear Probability Model
generating a dummy variable in STATA: gen d=wage>574

Benefits of LPM: Simplicity (to run, estimate, interpret)
Co-efficients are marginal effects
We get goodness-of-fit statistics (R^2)
Unbiased (By Gauss-Markov)

Disadvantage of LPM: $P > 1$ or $P < 0$
STATA: rvfplot (Residuals are totally linear) not randomly distributed
$Var = \hat{p}(1-\hat{p})$ (Violates homoskedasticity)

Logit Model

$$Pr(y=1|x) = \beta_0 + \beta_1 x + u \quad (\text{or} = \beta_1 x)$$

$$\Lambda(z) = \frac{e^z}{1+e^z} \Rightarrow \Lambda(-\infty) = 0 \qquad \Lambda(\infty) = 1$$

$$Pr(y=1|x) = \Lambda(\beta x) = \frac{e^{\beta x}}{1+e^{\beta x}}$$

$$p = \frac{e^z}{1+e^z} \Rightarrow e^z = \underbrace{\frac{p}{1-p}}_{\text{Odd Ratio}}$$

$$z = \ln(p/_{1-p})$$

STATA: logit d educ exper

Ask about the difference

The coefficient is the effect on the odd ratio

Use logistic d educ exper

The co-efficent is the impact on odd ratio

STATA: use mfx for marginal probability
~~use elf to plot the mar~~

Pseudo-R^2

$$\text{Pseudo-}R^2 = 1 - \frac{\mathcal{L}_1}{\mathcal{L}_0} \qquad (\text{Log(Likelihood)})$$

Log(Likelihood)

$y = [1 \ 0 \ 0 \ 1 \ 1]$ (ex.)

What are the value of β_0 and β_1 that maximise the likelihood (probability) of observing the data.

We have $\prod p(y_i) = e\{\sum \ln(p(y_i))\}$

Probit Model

$$Pr(y=1 \mid x) = \Phi(\beta x)$$

STATA: probit d educ exper

Near the averages: Logit = 4 OLS
Probit = 2.5 OLS
Logit = 1.6 OLS

{Rule of Thumb}