R301 Revision notes

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Plan

- I want a list of all the model definitions and how they relate to each other.
- Below this have a description of each one and the key assumptions.
- probit, logit, control function, reduced form [think there were some others in this category]
- Pure conditional logit, Multinomial logit, multinomial probit (trinomial probit), mixed logit
- FE, RE, CRE
- Bayesian stuff? bayes factor/odds ratio

Binary response models

- Partial Effect: $\frac{\partial E_u[Y(x)]}{\partial x} = \frac{\partial F(x)}{\partial x}$ this is an random variable associated with x. Two associated objects of interest are: Partial Effect at the Average (PEA) – $\frac{\partial F(x)}{\partial x}\Big|_{x_e=E(x)}$ and the Average Partial Effect (APE) – $E\left[\frac{\partial F(x)}{\partial x}\right]$
- Partial effects in probit model with unobserved heterogeneity. c_i denotes unobserved heterogeneity.

$$\begin{aligned} P(y_i = 1|x_i, c_i) &= \Phi(x_i\beta + \gamma c_i) \\ &= \Phi(x_i\beta/\sigma) \\ \text{Where} \qquad \sigma &= \gamma^2\tau^2 + 1 \end{aligned}$$

  So there is attenuation bias in the coefficient estimates of β since we do not know γ or τ. We cannot get correct partial effects for this reason.

- We can still get the APE since

$$E_c[\beta\phi(x_i\beta + \gamma c_i)] = \frac{\beta}{\sigma}\phi(\frac{\beta x_i}{\sigma})$$

  anyway. And this is what we estimate. If there is correlation we will not get consistent estimates of the APE in probit, but we won't in linear models either.

- **Control Functions** Generic definition is a variable that when added to a regression renders an endogenous variable exogenous. In our setting we view it as an alternative to other IV estimators.

- Aside: the model or structural model refers to the equation we are trying to estimate. The **reduced form** tells us how certain variables are linked together. For example, if there is a variable that can solve as an instrument it will be in the reduced form.

- We consider four situations:

Structural Model	**Reduced form**	**Estimation technique**
Linear	Linear	CF, 2SLS
Linear	Nonlinear	CF
Nonlinear	Linear	CF, 2SLS
Nonlinear	Nonlinear	MLE

- Consider a control function approach to the continuous linear-linear problem. $y = x^e\beta_o + x^o\beta_o + \epsilon$ and reduced form $x^e = z\theta + e$. We require 2SLS assumptions. Control function approach: estimate a model for the endogenous explanatory variables (EEVs) as a function of the instruments – i.e. the reduced form. And then use these residuals in the structural model.

- Control function is good because it gets around the forbidden regression for linear structural model vs nonlinear reduced form.

- Aside on the forbidden regression