Econ 311: Definitions of Exogeneity and Causality

(1) Weak Exogeneity

(2) Granger Noncausality

(3) Strong Exogeneity

(4) Super Exogeneity

(5) Strict Exogeneity

(6) External Variable

(7) Policy Invariant Structural Parameter

(8) Autonomous Relationship

Take the Parametric Case

$$Q_t = (Y_t, X_t) \qquad t = 1, \ldots, T$$

$\theta \in \underline{\theta} \subset R^n$ parametric family

1. $f(Q_t \mid \overline{Q}_{t-1}, \theta) =$
$f(Y_t \mid X_t, Q_{t-1}, \theta) \cdot f(X_t \mid Q_{t-1}, \theta)$

$$\varphi = f(\theta) \qquad 1-1$$

$$\varphi \in \Phi; \theta \in \underline{\theta}$$

Can always write (with φ_1, φ_2 together as reparameterization of θ)

$$f(Q_t \mid Q_{t-1}, \theta) = f(Y_t \mid X_t, Q_{t-1}, \varphi_1) f(X_t \mid Q_{t-1}, \varphi_2)$$

Weak Exogeneity

Notice we can always achieve (1).

Suppose we seek to learn about ψ and suppose that

(a) $\psi = g(\varphi_1)$ g is not necessarily $1-1$;

(b) φ_1 and φ_2 are variation free:

$(\varphi_1, \varphi_2) \in \Phi_1 \times \Phi_2 = \{(\varphi_1, \varphi_2) : \varphi_1 \in \Phi_1, \varphi_2 \in \Phi_2\}$

Definition: Then X_t is weakly exogenous (for ψ) if we have (a) and (b) holding.