Econ 311

1 A Framework For Counterfactuals And Causal Inference

(A-1) Two potential states, "untreated" and "treated," with corresponding potential outcomes given by the variables (y_0, y_1), y_0, $y_1 \in \Re$. Extension to more than two potential outcomes is straightforward.

(A-2) No market or social interactions among agents in the hypothetical world.

(A-3) A static model.

A causal function for each state,

$$y_0 = g_0(x)$$

$$y_1 = g_1(x).$$

Letting $\mathcal{D}_i$ be the domain of function g_i, $g_0 : \mathcal{D}_0 \mapsto \Re$, $g_1 : \mathcal{D}_1 \mapsto \Re$ and $\mathcal{D}_i \subseteq \Re^J$.

Let $(\Omega, \mathcal{A}, P)$ denote a probability space. The random variables for the potential outcomes are $(Y_0(\omega), Y_1(\omega))$ $X(\omega)$ produces the random variable $Y(\omega)$,

(2-1a) $$Y_0(\omega) = g_0(X(\omega))$$

(2-1b) $$Y_1(\omega) = g_1(X(\omega))$$

g_0, g_1 functions are playing two roles in our analysis.

They are describing not only how the random vector $X(\omega)$ is functionally related to the random variables $Y_0(\omega)$, $Y_1(\omega)$, but also are specifying what values the outcomes would have taken had the causes $X(\omega)$ taken alternative values.

A causal relationship is only well defined if a theory relating causes to outcomes is articulated and a mechanism generating