Econ 399 W08 MIDTERM

1) Economic Model

- *Theoretical* statement of relationship [redacted]
between y + x variables

ie $Utility = F(\text{income, hambergers, intellect})$ [redacted]

TRUE Econometric Model

- *Mathematical* statement of relationship [redacted]
between y + x variables

ie $$Utility_i = \beta_0 + \beta_1 \, income_i^2 + \beta_2 \, hambergers_i + \beta_3 \ln(intellect)_i + u$$ [redacted]

ESTIMATED Econometric Model

- *Estimated* Mathematical relationship
between *AVAILABLE* data [redacted]

ie $$\widehat{Utility}_i = 6.7 + 1.3 I_i^2 + 0.4 H_i$$ [redacted]

(2a) $\hat{\lambda}_1 = \dfrac{\Sigma(A-\bar{A})(B-\bar{B})}{\Sigma(A-\bar{A})^2} = \dfrac{\Sigma(A-\bar{A})B}{SST_A} = \dfrac{75}{25} = 3$ [redacted]

$\hat{\lambda}_0 = \bar{B} - \hat{\lambda}_1 \bar{A}$

$= 12 - 3(8)$

$= -12$ [redacted]

(b) $SSR = SST_B - SSE$

$= 45 - 15 = 30$ [redacted]

$R^2 = \dfrac{SSE}{SST_B} = \dfrac{15}{45} = \dfrac{1}{3}$ [redacted]

(c) $\boxed{\Delta\hat{B} = 3\Delta\hat{A}}$ if $\Delta u = 0$ [redacted]

(d) $\hat{\sigma}^2 = \dfrac{SSR}{n-k-1} = \dfrac{30}{62-2} = 0.5$ [redacted]

(e) $\hat{\phi}_1 = \dfrac{\Sigma AB}{\Sigma A} = \dfrac{32}{8(62)} = 0.0645$ [redacted]

3) a) If Aspartame has no <u>TRUE</u> effect

-> No negative implications of exclusion

-> Including increases multicollinearity

b) If Aspartame has a TRUE effect,

-> This will cause bias in the model (invalidate all results) unless Aspartame is uncorrelated w/ ALL other explanatory variables

-> Omitting Aspartame will put it into the error, increasing error variance

-> Omitting Aspartame will generally fight multicollinearity unless it is uncorrelated w/ all x's.

(4) $\Sigma \hat{e}^2 = \Sigma(y_1 - \hat{\beta}_0 - \hat{\beta}_1 x_1 + \hat{\beta}_2 x_2 + \hat{\beta}_3 x_3)^2$

$\frac{\partial \Sigma \hat{e}^2}{\partial \hat{\beta}_0} = \Sigma(y_1 - \hat{\beta}_0 - \hat{\beta}_1 x_1 + \hat{\beta}_2 x_2 + \hat{\beta}_3 x_3) = 0 \Rightarrow \Sigma \hat{e} = 0$

$\frac{\partial \Sigma \hat{e}^2}{\partial \hat{\beta}_1} = \Sigma($ " $)x_1 = 0 \Rightarrow \Sigma \hat{e} x_1 = 0$

$\frac{\partial \Sigma \hat{e}^2}{\partial \hat{\beta}_2} = \Sigma$ " $)x_2 = 0 \Rightarrow \Sigma \hat{e} x_2 = 0$

$\frac{\partial \Sigma \hat{e}^2}{\partial \hat{\beta}_3} = \Sigma$ " $)x_3 = 0 \Rightarrow \Sigma \hat{e} x_3 = 0$

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(5)

(1) Bias – Purposeful poor selection

(2) Sample Selection Problem – Accidental poor selection

(3) Small Sample – not representative

(4) Large Sample – ie >80% of pop

(6a) genr lp = log(price)

genr lq = log(quantity)

genr li = log(income)

OLS lp lq li Advertising

(b) Test li = 0

(7) Partialling out analyzes x_i's effect on y by first removing x_i's correlation w/ all other x's

STEP 1: Regress $x_i = f(\text{other } x\text{'s})$
Obtain residuals $\hat{r}$

$\left.\right\}$ This removes correlation

STEP 2: Calculate $\hat{B}_i = \dfrac{\sum \hat{r} y}{\sum \hat{r}^2}$

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(8) $\text{Bias} = E(\breve{B}_J) - B_J$

$= B_J + E\left(\dfrac{\bar{x} - 5}{Var(u)}\right) - B_J$

$= (\bar{x} - 5) E\left(\dfrac{1}{Var(u)}\right)$

$\text{Biax} = 0$ when $\bar{x} - 5 = 0$

$\bar{x} = 5$

(9) Unbiasedness = sample
Consisten = population

(10a) $\hat{UTIL} = \underset{(7.33)}{-6.34} + \underset{(0.18)}{3.62} Social_i + \underset{(0.99)}{2.96} Mark_i - \underset{(0.25)}{2.44} Work_i$
$+ \underset{(0.98)}{0.198} Class_i + \underset{(0.098)}{0.00572} Build_i$ $R^2 = 0.7684$
$N = 168$

$\hat{UTIL} = \underset{(5.59)}{-5.46} + \underset{(0.18)}{3.62} Social_i + \underset{(0.97)}{2.99} Mark_i - \underset{(0.25)}{2.44} Work_i$ $R^2 = 0.7683$
$N = 168$

(b) $H_0: \beta_4 = 0$
$H_a: \beta_4 \neq 0$

$t = \dfrac{\hat{\beta}_4}{se(\hat{\beta}_4)} = \dfrac{0.198}{0.98} = 0.20$

$t^*_{\alpha=0.05\ df=\infty} = 1.960$

$t < t^*$, DO NOT reject H_0; class doesn't matter @ $\alpha = 5\%$

(c) $H_0: \beta_5 \leq 0$
$H_a: \beta_5 > 0$

$t = \hat{\beta}_5 / se(\hat{\beta}_5) = \dfrac{0.00572}{0.098} = 0.584$

$t^*_{\alpha=0.1, df=\infty} = 1.282$

$t < t^*$, DO NOT reject H_0, build doesn't have a +'ve effect on util @ $\alpha = 10\%$

(d) $H_0: \beta_4 = \beta_5 = 0$
H_a: Not H_0

$F = \dfrac{(R^2_{UR} - R^2_r)/q}{(1 - R^2_{UR})/(n-k-1)} = \dfrac{(0.7684 - 0.7683)/2}{(1 - 0.7684)/(168-6-1)}$

$= \dfrac{0.0001/2}{0.2316/161} = 0.035$

$F^*_{dF=2,161} \doteq 4.61$

Therefore, since $F < F^*$, DO NOT reject H_0; class & build are jointly insignificant @ $\alpha = 1\%$

(e) $H_0: \beta_0 = \beta_1 = \dots = \beta_5 = 0$ (Model insignificant)
H_a: Not H_0

$F^*_{dF=6,161} = 2.80$

$F = \dfrac{R^2/K}{(1-R^2)(n-k-1)} = \dfrac{0.7684/6}{(1-0.7684)/(168-6-1)}$

$= 89.0$

$F > F^*$, reject H_0; model is significant @ $\alpha = 0.01$.

Econ394-M08
MT

10F $CI = \hat{B}_j \pm t^{*} se \hat{B}_j$

$t^{*}_{\alpha=0.1, df=\infty} = 1.645$

$CI_{\hat{B}_1} = 3.62 \pm 1.645(0.18)$
$= [3.323, 3.916]$

$CI_{\hat{B}_0} = 2.99 \pm 1.645(0.97)$
$= [1.39, 4.59]$

$CI_{\hat{B}_3} = -2.44 \pm 1.645(0.25)$
$= [-2.85, -2.03]$