ECON 7010: Econometrics I

Mid-Term Test Formulae Sheet

Standard regression model: $\quad y = X\beta + \varepsilon$

OLS estimator: $\quad b = (X'X)^{-1}X'y$

Residual vector: $\quad e = (y - \hat{y}) = y - Xb$

Estimator of error variance: $\quad s^2 = (e'e)/(n - k)$

Covariance matrix for random vector, x: $\quad V(x) = E[(x - E(x))(x - E(x))']$

Covariance matrix for errors: $\quad V(\varepsilon) = \sigma^2 I_n$

Usual idempotent ("projection") matrix: $\quad M = I_n - X(X'X)^{-1}X'$

Vector differentiation:
$$\partial(a'x)/\partial x = a$$
$$\partial(x'Ax)/\partial x = 2Ax \quad \text{(if } A \text{ is symmetric)}$$

Deviations about means matrix: $\quad M_0 = I_n - (1/n)1\,1' \quad ; \text{ where } 1' = (1,1,1,.....,1)$

Coefficient of determination: $\quad R^2 = 1 - [(e'e)/\sum_{i=1}^{n}(y_i - \bar{y})^2] = 1 - [(e'e)/(y'M_0 y)]$

Mean squared error: $\quad MSE(\hat{\theta}) = \text{var.}(\hat{\theta}) + [Bias(\hat{\theta})]^2$

t-statistic: $\quad t_i = (b_i - \beta_i)/(s.e.(b_i)) \sim t_{n-k}$

Confidence interval: $\quad [b_i - t_c s.e.(b_i) \quad , \quad b_i + t_c s.e.(b_i)]$

F-statistic:
$$F = \{(Rb - q)'[R(X'X)^{-1}R']^{-1}(Rb - q)/J\}/s^2$$
$$= [(e^{*'}e^* - e'e)/J]/[(e'e)/(n - k)]$$

Wald test statistic: $\quad W = (Rb - q)'[R(X'X)^{-1}R']^{-1}(Rb - q)/s^2$

IV estimator: (just-identified) $\quad \hat{\beta}_{IV} = (Z'X)^{-1}Z'y$

(over-identified) $\quad \hat{\beta}_{IV} = [X'Z(Z'Z)^{-1}Z'X]^{-1}X'Z(Z'Z)^{-1}Z'y$

Hausman test statistic: $\quad H = (b_I - b_E)'[\hat{V}(b_I) - \hat{V}(b_E)]^{-1}(b_I - b_E)$