Midterm

1. Consider the regression

$$y_i = g(x_i\beta) + u_i, \ i = 1, 2, \ldots, n$$

where $g(\cdot)$ is a known, possibly non-linear, function. The vector x includes k regressors and an intercept term. β is the corresponding parameter vector of dimension $(k+1)$.

   (a) Given the type of argument in $g(\cdot)$, what is the common name for this conditional mean function?

   (b) What dimension is $g(x_i\beta)$?

   (c) Give the marginal effects for this regression model.

   (d) Write a specific function for $g(\cdot)$ such that the marginal effect is increasing with x.

   (e) Write a specific function for $g(\cdot)$ such that the marginal effect is decreasing with x.

   (f) For the function given in (d), what is the average marginal effect for all individuals?

   (g) For the function given in (e), what is the marginal effect for the average individual?

   (h) Write a specific function for $g(\cdot)$, such that the marginal effect is constant.

2. Consider the regression model

$$y_i = g(x_i, \beta) + u_i, \ i = 1, 2, \ldots, n$$

where $g(\cdot)$ is a known, possibly non-linear, function. The vector x includes k regressors and an intercept term. β is the parameter vector. Suppose that $E(u|x) \neq 0$, but there exists a set of instruments z (of dimension r) such that $E(u|z) = 0$.

   (a) Write the objective function for the GMM estimator.

   (b) Write the first-order conditions for the objective function in part (a).

   (c) Give the variance of the estimator obtained from the objective function in part (a).

   (d) Give the objective function for the optimal GMM estimator relative to part (a).

   (e) Noting that the weighting matrix is $\left(\frac{1}{n}\sum_{i=1}^{n} z_i'z_i\right)^{-1}$, give the objective function for the NL2SLS estimator.

(f) Assuming we are in the just-identified case, what estimator is equivalent to the estimator in part (e)?

(g) For the case where the conditional mean is linear, show that these two estimators (parts e and f) are equivalent.

3. Answer these questions about the assigned paper from class (Mullahy, 1997 – *Review of Economics and Statistics*).

(a) Briefly explain why the standard nonlinear-IV estimator will not consistently estimate the parameter vector (named α in the paper)?

(b) What is the left-hand-side variable in each application?

(c) What is the endogenous regressor in each application?