Homework # 3

1. Consider the following equations representing the demand and supply of wheat (for notational simplicity, the t-subscript is omitted):

$$\begin{aligned} q_d &= \alpha_0 + \alpha_1 p + \alpha_2 y + u && (1) \\ q_s &= \beta_0 + \beta_1 p + \beta_2 r + \nu && (2) \\ q_d &= q_s && (3) \end{aligned}$$

where q_d is the quantity of wheat demanded, q_s is the supply of wheat, p is the price, y is income, r is the amount of rainfall, and u and ν are stochastic disturbance terms.

   (a) The order condition of identifiability: Is the order condition satisfied for demand and supply structural equations? Explain in your own words what it means to impose exclusion restrictions on the model or, in other words, to correctly exclude a variable from the model. *[0.5]*

   (b) The rank condition of identifiability: Is the rank condition satisfied for demand and supply structural equations? How would you proceed with IV estimation? Why in our case 2SLS will yield the same estimation results? *[0.5]*

   (c) Indirect least squares: From the structure form of the simultaneous-equation model (SEM) derive the reduced form and state the equations which allow us to retrieve the structural estimates from the reduced form estimates. *[0.5]*

2. *Marginal effects*

   (a) What is a crucial difference between a linear probability model (LPM) and probit or logit models when estimating the effects of the x_j on the response probabilities, $P(y = 1|\mathbf{x})$?
   Following the discussion on page 561 about equation 17.13, provide a more accurate comparison of the probit and logit slope estimates assuming that you have obtained $\hat{\beta}_0 + \bar{\mathbf{x}}\hat{\beta} = 2.2$. *[1]*

   (b) Problem 17.3 *[1.5]*

3. Derive expression 17.50 in Appendix 17A for probit and logit models (Hint: this is " a proof by a look-up," e.g. see Maddala, 1983, Limited Dependent and Qualitative Variables in Econometrics, Section 2.5, pp. 22-27; the scanned pages are available). *[1]*

4. Assume that you are given $\ln y = \beta_0 + \beta_1 x_1 + \cdots + \beta_k x_k + u$, where $u \sim \mathcal{N}(0, \sigma^2)$. Show that $E(y|x) = e^{\frac{\sigma_u^2}{2}} \cdot e^{\beta_0 + \beta_1 x_1 + \cdots + \beta_k x_k}$. *[1]*

5. Problems 16.10 and 17.11. Provide a description for the estimation procedure before presenting the estimated models. This refers in particular to describing the regressions you run, the potentially endogenous explanatory variable(s), the suggested instrumental variable(s), and the test statistics. Also provide as an attached printout the Stata log file containing the program code and estimation output. *[4]*