PhD Qualifier Examination

Department of Agricultural Economics

August 1, 2023

Instructions

This exam consists of **six** questions. You must answer all questions. If you need an assumption to complete a question, state the assumption clearly and proceed. Be as clear as possible in your answer. You have four hours to complete the exam. Show all your work. If necessary, use math, graphical analysis and provide definitions of key concepts.

- Be sure to put your assigned letter and no other identifying information on each page of your answer sheets.
- Also, put the question number, answer page number, and total number of answer pages for that question (e.g. Question 4 Page 1 of 3) at the top of each page.
- Write on only one side of your paper and leave at least 1 inch margins on all sides.
- Make sure your writing is clear and easy to read.
- Turn in your final copy with all pages **in order.**

GOOD LUCK!

1. (20 points) Suppose that there is a risk-neutral individual (the seller) who wishes to sell an object that she is commonly known to value at zero. Suppose also that there are two risk-neutral individuals (the bidders) interested in buying the object. The buyers' valuations, v_1 and v_2, are drawn independently from the uniform distribution on $[0, 1]$ and are private information. Consider a first price seal bid auction with no reserve price or entry fee. Suppose that each of the bidders believes that his rival is a phoney bidder with probability $\alpha \in [0, 1]$. A phoney bidder is an agent of the seller who submits a blank bid (i.e., never wins)-his only role is to increase the apparent competition level in the auction. Let $b(v)$ be a symmetric differentiable, increasing BNE bidding function for a non-phoney bidder.

   (a) If a phoney bidder 2 submits a blank bid and a non-phoney bidder 2 bids according to $b(v)$, what is bidder 1's probability of winning the auction when he bids according to some bid function $\tilde{b}(v)$?

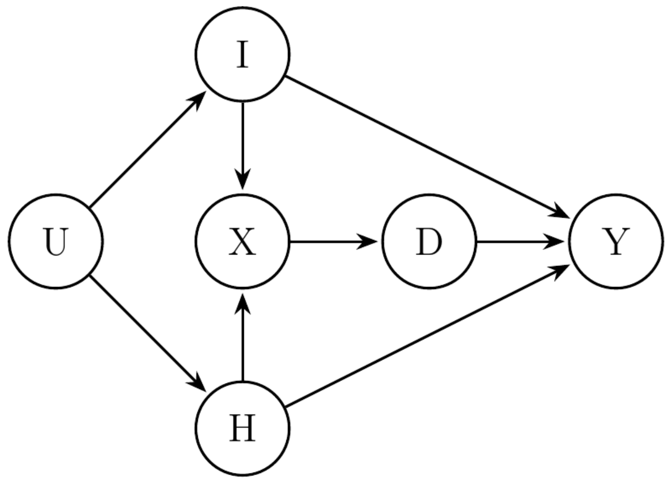
   (b) If a phoney bidder 2 submits a blank bid and a non-phoney bidder 2 bids according to $b(v)$, what is bidder 1's interim expected payoff $\tilde{\pi}_1(v, \tilde{b})$?

   (c) What is the first-order optimality condition defining bidder 1's optimal bid $\tilde{b}^*(v)$?

   (d) Use the fact that $\tilde{b}^*(v) = b(v)$ to derive $b(v)$.

   (e) How does the equilibrium bidding behavior change with α?

2. (15 points) Consider a research project where you are investigating the total causal effect of drinking (X) on people's life span (Y). The study also includes factors such as income status (I), health status (H), and drug use (D). Unobservable factors that may impact income (I) and health (H) are represented by (U). The hypothetical Directed Acyclic Graph (DAG) of this project is as follows:



   (a) Explain the concept of "backdoor paths" within the context of this DAG. Identify all backdoor paths between X and Y. Discuss whether these paths introduce a confounding bias in the estimation of the causal effect of drinking on life span.

   (b) Applying the "backdoor criterion", suggest an appropriate identification strategy to estimate the total causal effect of X on Y. Present your regression formula. Remember, variable U is unobservable and thus, not available in your dataset. Specify any assumptions necessary for the validity of your proposed strategy.

3. (15 points) Consider a moving average process MA(1) :

$$y_t = \epsilon_t + \beta_1 \epsilon_{t-1}, \tag{1}$$

where ϵ_t is white noise, denoted by $\epsilon_t \sim WN(0, \sigma^2)$.

(a) Define the concept of covariance stationarity for time series data.

(b) Demonstrate that the above MA(1) is covariance stationary. Make necessary assumptions if needed.

(c) In empirical research, how can we determine if a data series is stationary? What are the potential consequences of running a regression model with non-stationary data?

4. (20 points) Consider a panel data model

$$Y_{it} = X_{it}\beta + c_i + u_{it}, \quad i = 1, \ldots, N, \quad t = 1, \ldots, T,$$

Let $v_{it} = c_i + u_{it}$ and $v_i = (v_{i1}, \ldots, v_{iT})'$. Some of following assumptions will be needed:

(i) $E[u_{it}|X_{i1}, \ldots, X_{iT}, c_i] = 0$ and $E[c_i|X_{i1}, ..., X_{iT}] = 0$ for all i's and t's

(ii) $E[v_i v_i'|X_{i1}, ..., X_{it}] = \Sigma$ for all i's, where Σ is symmetric and positive-definite.

(iii) $E[v_i v_i'|X_{i1}, ..., X_{it}] = \Sigma$ for all i's with diagonal entries being $\sigma_c^2 + \sigma_u^2$ and non-diagonal entries being σ_c^2 if $i \neq j$.

(a) Suppose assumption (i) holds and the model is estimated by the ordinary least squares estimator (OLS). Is the estimator unbiased? Is it efficient?

(b) Suppose assumptons (i) and (ii) hold. Propose a feasible generalized least squares estimator (FGLS). State the necessary steps to implement your proposed estimator. Discuss the large sample properties of this estimator.

(c) Suppose assumptions (i) and (iii) hold. Propose a FGLS estimator. State the necessary steps to implement your proposed estimator. Discuss the large sample properties of this estimator.

(d) Denote your proposed estimators to parts (b) and (c) by estimators (b) and (c) respectively. Compare the large sample properties of these two estimators under assumptions (i) and (iii).

5. (15 points) Suppose that x is the demand function associated with a strictly convex preference B on $\mathbb{R}^L_+$. We say that commodity $k \in \{1, \ldots, L\}$ is a luxury good if for each $p >> 0$ and each $w \geq 0$ for which $x_k > 0$, the income elasticity of x_k is greater than or equal to 1.

   (a) Suppose that B is homothetic. Show that then all commodities are luxury goods for this agent.

   (b) Suppose that B is quasi-linear with respect to commodity h. Determine if any commodity $l \neq h$ is a luxury good for the agent. What about h?

6. (15 points) Let $D = \{(p_k, w_k, x_k)\}_{k=1}^{K}$ be a demand data set. Let $(R, >)$ be the binary relations defined as follows: $x\,R\,y$ iff there is $k \in \{1, .., K\}$, such that $x_k = x$ and $p \cdot y \leq p \cdot x_k$; and $x > y$ iff there is $k \in \{1, .., K\}$, such that $x_k = x$, $y \neq x$ and $p \cdot y \leq p \cdot x_k$.

   (a) Define acyclicity of $(R, >)$

   (b) Prove that if $(R, >)$ is acyclic, there is a preference that strongly rationalizes behavior. (You can use the theorems proved in class, you need to make sure that they apply in the objects you are defining).