

**Market and Information Economics**  
**Preliminary Examination**  
**Department of Agricultural Economics**  
**Texas A&M University**

May 2015

Instructions: This examination consists of six questions. You must answer the first question and you must answer four of the remaining five questions (i.e. answer four of the questions numbered 2-6). Each question answered (five in total) has a weight of 20% in the final examination score. Please read through the entire examination before making a decision on the particular set of five questions you actually answer. The examination proctor will review the content of the exam at the beginning of the time period (9:00 am). He will answer general questions for the entire set of students writing this prelim. You have until 1:15 pm to complete the exam. Good Luck!

### You Must Answer this Question

1. The sugar refining industry was highly concentrated in the late 1800s as the result of acquisitions by the Sugar Trust, which was later incorporated as the American Sugar Refining Company and controlled more than 80% of the industry's capacity. Refined sugar was a homogeneous product (100% sucrose), purified and crystallized from raw sugar. The grocers packaged the refined sugar for consumers without any identification of the manufacturer. Detailed market data for this industry for 1880-1914 are available as a result of antitrust litigation. Genesove and Mullin (1998) used these data to infer market conduct of the sugar refining industry under the hypothesis of static oligopoly behavior. Suppose that the demand curve of the refined sugar has the particular linear form

$$p = \alpha_0 + \alpha_1 Q + \alpha_2 Z + \alpha_3 ZQ + u_1,$$

where  $p$  is the price of refined sugar in the market,  $Q$  is output,  $Z$  is another variable that affects demands, such as income or the price of a substitute, and  $u_1$  is the error term.

Suppose that the firm's marginal cost curve is linear in  $Q$  and raw sugar price  $W$ , with error term  $u_2$ ,

$$MC = \beta_0 + \beta_1 Q + \beta_2 W + u_2$$

Define the effective marginal revenue as

$$MR = p + \lambda p_Q Q,$$

where  $\lambda$  is a parameter to be estimated and  $p_Q \equiv \partial p / \partial Q$ .

- (a) Provide the interpretation of  $\lambda$ .
- (b) Derive Lerner's index as a function of  $\lambda$  and market elasticity of demand. Show your work.
- (c) Suppose you have the data of  $p$ ,  $Q$ ,  $Z$ ,  $W$ , but not  $MC$ . Explain in details how to obtain an estimate of  $\lambda$ .
- (d) If there is no  $ZQ$  term (that is, if  $\alpha_3=0$ ) in the demand curve, discuss the estimation of  $\lambda$  based on the information about  $MC$ .

**Answer four of the following five questions**

2. Roll Global, a private company and big supporter of scientific research on health benefits of fruits and vegetables, is interested in research on consumer demand for fruit and vegetable juices in the United States. Specifically, Roll Global expressed interest in particular products, namely super premium juices, 100% fruit juices, 100% vegetable juices, frozen juices, juice drinks, and other beverage categories. In order to obtain research funds, Roll Global required a formal research proposal. In such a proposal, you are specifically to do the following:

In a quantitative and qualitative manner:

- a. Develop and justify a theoretical model to analyze the consumer demand of the various beverages in the United States.
- b. Describe in some detail the source of data and the statistical procedure(s) to carry out the empirical work.
- c. Describe the types of information provided by the research model.
- d. Describe the usefulness of the information in (c).
- e. Discuss empirical and theoretical problems with respect to such research.
- f. Show how to possibly resolve the problems in (e).

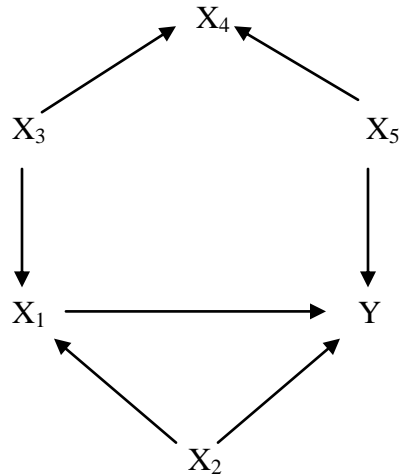
3. For the following vector autoregression (VAR):

$$\begin{bmatrix} X_{1t} \\ X_{2t} \\ X_{3t} \end{bmatrix} = \begin{bmatrix} .9 & -.2 & .3 \\ 0 & .8 & 0 \\ 0 & .5 & 1.1 \end{bmatrix} \begin{bmatrix} X_{1t-1} \\ X_{2t-1} \\ X_{3t-1} \end{bmatrix} + \begin{bmatrix} -.3 & .4 & 0 \\ 0 & -.3 & 0 \\ 0 & -.2 & -.3 \end{bmatrix} \begin{bmatrix} X_{1t-2} \\ X_{2t-2} \\ X_{3t-2} \end{bmatrix} + \begin{bmatrix} e_{1t} \\ e_{2t} \\ e_{3t} \end{bmatrix}$$

a. Discuss assumptions made on the correlation between contemporaneous innovations in deriving the moving average representation. What methods have been used in the literature to “solve” this problem? In matrix form, without individual elements (just use argument in compact matrix form:  $AX_t = BX_{t-1} + Ce_t$ ) suggest how one might transform the model given above to account for contemporaneous correlation among innovations. What information do we require for such a transformation to be meaningful? Suggest how one obtains the needed information.

b. Consider the Moving Average Representation of this system. Discuss three ways it can be studied and presented to help inform economic analysts (and policy makers) on the dynamic relationship between  $X_{1t}$ ,  $X_{2t}$  and  $X_{3t}$  and past or future values of each.

4. Consider the following graph and definition. Definition: A path  $p$  defined on the set of variables,  $X_i, i=1, \dots, 5$  and  $Y$  is said to be d-separated (blocked) by a set of nodes  $Z$  if and only if:



- i.  $p$  contains a chain  $X_i \rightarrow X_m \rightarrow Y$  or a fork  $X_i \leftarrow X_m \rightarrow Y$ , such that the middle node,  $X_m$ , is in  $Z$ .
- ii.  $p$  contains an inverted fork (collider)  $X_i \rightarrow X_m \leftarrow Y$  such that the middle node,  $X_m$ , is not in  $Z$  and no descendent of  $X_m$  is in  $Z$ .

Discuss this definition of -separation using the graph in order to estimate the effect of  $X_1$  on  $Y$ .

- a. Are  $X_3$  and  $X_5$  unconditionally d-separated? Are  $X_3$  and  $X_5$  given knowledge of  $X_4$  d-separated?
- b. Need we account for  $X_4$  (include it) in an OLS regression of  $Y$  on  $X_1$  if we are interested in obtaining an unbiased estimate of  $\partial Y / \partial X_1$ ? Why or why not?
- c. Need we account for  $X_2$  (include in the regression) in an OLS regression of  $Y$  on  $X_1$  if we are interested in obtaining an unbiased estimate  $\partial Y / \partial X_1$ ? Why or why not?
- d. Specify one or more equations to consistently estimate the above partial derivative ( $\partial Y / \partial X_1$ ) with observational data. Does your answer change depending on whether  $X_4$  and  $X_2$  are observable or unobservable?
- e. Suppose  $X_2$  and  $X_4$  are not observable, what can we do to get a an unbiased and consistent estimate of  $\partial Y / \partial X_1$ ?

5. Let  $U(x)$  be an agent's utility on a lottery with distribution function  $F(x)$ . The classical Expected Utility theorem prescribes that the agent's valuation of the lottery is given by

$$V = \int U(x)dF(x).$$

Various alternative theories have been proposed to explain deviations from the EU framework. For instance, the Weighted Utility (WU) Theory postulates a positive weight function  $w$  such that

$$V = \int U(x)w(x)dF(x).$$

Alternatively, the Rank-Dependent Expected Utility (RDEU) Theory suggests a monotone probability distortion function:  $G(p) : [0, 1] \rightarrow [0, 1]$  with  $G(0) = 0$  and  $G(1) = 1$  such that

$$V = \int U(x)dG(F(x)).$$

- (a) Show that the WU and RDEU are observationally equivalent (i.e., in terms of agents' observable behavior) under mild conditions. Establish the relationship between the weight function  $w$  in the WU and the probability distortion function  $G$  in the RDEU under the equivalence.
- (b) Under what circumstances the WU or the RDEU provides a more plausible explanation for behaviors that are not consistent with the EU framework?
- (c) Is it possible to statistically test which theory (i.e, WU v.s. RDEU) is responsible for observed inconsistency with the EU? Explain your answer.

6. Let  $f$  be the physical density of  $S_T$ , the price of a financial asset at a future time  $T$ . Suppose that the present value of a derivative (e.g., an option) based on this financial asset is priced according to

$$V = \int C(S_T)p(S_T)dS_T,$$

where  $C$  is the payoff of the derivative at time  $T$ .

Denote by  $K(S) = p(S)/f(S)$  the pricing kernel of the derivative.

- (a) Propose an estimator of the pricing kernel. State clearly your data requirements and estimator procedure.
- (b) A pricing kernel different from unity indicates that the market prices the derivative according to a probability measure different from the physical density of its underlying financial asset. Provide explanations to this deviation from the principle of pricing according to expectation.
- (c) Does your answer to Part (b) depend on the existence of a risk free financial instrument? If no, explain why it is the case? If yes, show how your answer to Part (b) would change if there exists NO such a risk free financial instrument.
- (d) Show that the above framework can be used to price a crop insurance policy. Explain what form the payoff function  $C$  will take in this case. (Hint: in this case,  $S_T$  is the random crop yield with density  $f$ , and the 'pricing kernel' reduces to unity such that  $p(S) = f(S), \forall S.$  )