University of California, Davis

Department of Agricultural and Resource Economics

M.S. Comprehensive Exam, August 2017

You have four hours for this exam after a 20 minute reading period (8:30 am – 12:50 pm). You do not need to use the whole time period. This exam consists of 3 questions. They will have equal weight. The subsections within each question will have equal weight.

Watch the time carefully. The logic used to answer the question is important, so be sure to clearly specify your reasoning with full sentences. Supporting your answer as rigorously as possible, usually by diagrams or equations, is also important. This is not the time to economize on paper. Make any graphs you draw large and easily read. Make sure your writing is legible; if we can't read it, it will be assumed wrong.

1. Econometrics.

   a. State the assumptions under which the Least Squares Estimator is the Best Linear Unbiased Estimator (BLUE). Which of these assumptions are necessary for least squares to be unbiased? State the assumptions under which a least squares estimator provides a causal estimate.

   b. Write down a simple least squares model in which the coefficient of interest can be interpreted as a semi-elasticity. Write down a simple least squares model in which the coefficient of interest can be interpreted as an elasticity.

   c. Describe the instrumental variables estimator. State the assumptions under which the instrumental variables estimator provides a causal estimate. Provide an example of a situation where instrumental variables research design was used.

   d. Describe the difference-in-differences research design. State the assumptions under which the difference-in-differences research design provides a causal estimate. Provide an example of a situation where difference-in-differences research design was used.

   e. Describe the regression discontinuity research design. State the assumptions under which the regression discontinuity approach provides a causal estimate. Provide an example of a situation where the regression discontinuity research design was used.

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2. Understanding spatial market integration in a region helps to reveal how markets function and often has direct policy relevance.

   a. Describe the importance and policy relevancy of spatial market integration as it relates to famines that occurred periodically in Asia and Africa during the past century. Be specific and concise.

   b. Adam Smith chose this title for Chapter 3 of Book 1 of *Wealth of Nations*: "That the Division of Labour is limited by the Extent of the Market." Describe briefly how this chapter title relates to spatial market integration. Contrast and compare the basic idea captured in this title to your response in part (a) above.

   c. Explain carefully why the correlation of prices in spatially-distinct markets is a deficient measure of market integration.

d. Ravallion (1986) assumes the following price determination process for prices in hinterland markets: $P_{it} = \sum_{j=1}^{n} a_{ij} P_{it-j} + \sum_{j=0}^{n} b_{ij} P_{1t-j} + \sum_{s=1}^{m} c_{si} X_{sit} + e_{it}$, where P's are prices; X's are control variables; *a, b,* and *c* are coefficients; *e* is a stochastic error term; and *i* indexes hinterland market *i* and 1 represents the central market.

(i) What restrictions on these coefficients are implied by complete market separability (i.e., non-integration) between the central market and hinterland market *i*?

(ii) One testable hypothesis is that price changes in the central market are immediately transmitted to market *i* and that there are no lagged price transmission effects either from the central market or from market *i* itself. What restrictions on coefficients would you impose to test this hypothesis?

(iii) Another testable hypothesis is that price changes in the central market are immediately transmitted to market *i* and (in contrast to (ii)) that any lagged price effects vanish on average. What restrictions on coefficients would you impose to test this hypothesis?

(iv) At a long-run equilibrium, market prices are constant over time – i.e., $P_{it}=P^*_i$, $P_{1t}=P^*_1$, and $e_{it}=0$. A final testable hypothesis is that the central market is integrated with hinterland market *i* only at such a long run equilibrium. What restrictions on coefficients would you impose to test this hypothesis?

e. Ravallion (1986) uses this specification to test spatial market integration of rice markets in Bangladesh, where Dhaka is the central market. F-test statistics for the linear restrictions implied by (i)-(iv) above and for three hinterland rice markets are shown below.

	Rural District Markets		
Restriction	*Mymensingh*	*Rangpur*	*Sylhet*
d.(i)	18	14	16
d.(ii)	60	236	15
d.(iii)	7.1	99	6
d.(iv)	5.4	184	9.1

For a critical F-value of 10, write a brief paragraph that describes these results in policy relevant terms.

f. Identify and describe at least one limitation of tests of spatial market integration based on this specification. Discuss a potential remedy to this limitation and its empirical costs and benefits.

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3. Consider a consumer's utility function, $U = f(X, Z)$, where *X* and *Z* are goods. Assume $f(\cdot)$ is strictly increasing in both of its arguments. Also assume the function satisfies all mathematical properties to yield indifference curves that are smooth, downward sloping, and convex to the origin. Let the consumer's budget be denoted by *M* and let the prices for the two goods be denoted by P_X, P_Z.

a. Assume the consumer is a utility maximizer subject to her budget. Set up the consumer's optimization problem and take the first-order conditions, assuming that at the optimum the consumer will consume positive amounts of both goods.

b. Arrange your FOC to provide an intuitive interpretation of the conditions characterizing the consumer's optimum. Provide a verbal discussion of the optimum condition.

c. Illustrate the consumer's optimum in a large, carefully drawn graph.

d. Express the consumer's demand functions for goods *X* and *Z* using general functional notation. Explain verbally how you could obtain these functions based on your work in part (b) if you had been given the specific functional form of $f(\cdot)$.

e. Good *Z* is produced in a production process that emits substantial carbon. Suppose a carbon tax is placed on production of good *Z*, which causes the price of *Z* to increase from P_Z^0 to $P_Z^1 = 1.5P_Z^0$. Show graphically using indifference curves how this price increase will affect the consumer's consumption of good *Z*.

f. The following statement is true: *Any price change contains both an income and substitution effect.* Carefully explain what this statement means. Then on a large, carefully drawn graph illustrate the income and substitution effects for the price change indicated in part (e).

g. Many economists support the concept of a carbon tax to combat climate change. Usually the policy proposal is to make the tax revenue neutral by returning the tax revenue to taxpayers in a non-distorting way. Suppose this plan (carbon tax + rebate) were put into place. Does your answer in part (f) help us to understand how a carbon tax + rebate would work in practice relative to a policy of carbon tax without rebate—i.e., the scenario in part (e)? Even if you did not answer part (f), you can provide a verbal answer here for part credit.