WRITTEN PRELIMINARY Ph.D. EXAMINATION

Department of Applied Economics

University of Minnesota

January 30, 2015

MANAGERIAL, FINANCIAL, MARKETING

AND PRODUCTION ECONOMICS FIELD

Instructions:

- Write your code letter, not your name, and the page sequence on all sheets of paper and be sure to turn in these sheets at the end of the exam.

- Start each new question at the top of a new page. Please write legibly and on only one side of each page.

- This is a closed book exam. No notes, articles, books, or other sources may be used at the exam. You may not access the Internet for any reason while taking this exam. Accessing notes, articles, the internet, or other materials during the exam will result in a failing grade on the exam.

- The exam has two sections, and you are expected to answer exactly two questions in each section.

  Furthermore, you must answer Question 1, in Section I. You may answer any two of the three questions in Section II.

- You have four hours to complete this examination.
Section I – Production Economics

**Question 1.** Let $\mathbf{y} \in \mathbb{R}_+^m$ and $\mathbf{x} \in \mathbb{R}_+^n$ represent a vector of outputs and inputs respectively, and let $Y(\mathbf{x}) = \{\mathbf{y}: \mathbf{x} \text{ can produce } \mathbf{y}\}$ represent the producible output set. Consider the *directional output distance function* defined by

$$\overrightarrow{D}_o(\mathbf{y}, \mathbf{x}; \mathbf{g}) \equiv sup\{\theta: \mathbf{y} + \theta\mathbf{g} \in Y(\mathbf{x})\}$$

where $\mathbf{g} \in \mathbb{R}_+^m$ is a directional vector as typically defined. Show that under free disposability of inputs and outputs, $\overrightarrow{D}_o(\mathbf{y}, \mathbf{x}; \mathbf{g})$ is a complete function representation of the technology in the sense that

$$\overrightarrow{D}_o(\mathbf{y}, \mathbf{x}; \mathbf{g}) \geq 0 \Leftrightarrow \mathbf{y} \in Y(\mathbf{x})$$
Question 2. A subsistence household in India grows rice for consumption and income. Assume the household’s rice production technology is summarized by the production function

\[ y = 50l^{0.5}h^{0.25}z^{0.25} \]  

(2.1)

Here \( y \) represents rice yield in pounds, \( x \) represents the level of labor demanded in man-hours, \( h \) represents the level of water used in 1,000 cubic meters, and \( z \) represents cultivated area in acres. Cultivated area is fixed for the household, and the household’s endowment of land is \( z = 1 \). Furthermore, the wage rate is \( p_l = 25 \) rupee per unit of labor and each unit of \( h \) cost \( p_h = 25 \) rupee. The output price is \( p = 5 \) rupee per pound of rice.

a. Derive the value-added function for land.

b. Is the value-added function you derived in part a:
   i. Homogeneous of degree zero in output and factor prices? Explain your answer.
   ii. Non-decreasing and concave in the output price? Explain your answer.

c. At the prevailing factor and output prices
   i. How many units of labor and how many units of water will maximize land rent?
   ii. How much would the household be willing to pay to rent an additional unit of land?

d. Assume that, in addition to one unit of land, the household is also endowed with 50 units of water and can purchase more water at the prevailing market price. By how much would his/her income change?

e. Let household preferences be given by \( U = q_1^{0.4}q_2^{0.6} \), where \( q_1 \) is the amount of rice consumed and \( q_2 \) is an index of all other consumption. Given the original technology (household is only endowed with a unit of land) and prevailing market prices, how much rice will the household purchase from, or sell to, the market? Explain how you arrived at your answer.

f. Assume the only information you have about production is equation (2.1), i.e., knowledge of the household’s production technology. If the household sold all its rice on the market and earned 10,000 rupee, explain how you would figure out how much income it earned.
**Question 3.** Suppose a food product, $Y$, is produced by only two factors: a marketing input $X_1$ and a primary farm input $X_2$. $Y$ is produced by a competitive industry in which all firms use the same technology. In this technology the marginal physical product $X_1$ is constant (independent of the amounts of both $X_1$ and $X_2$) while the marginal physical product of $X_2$ diminishes as its quantity increases. The supply of factor $X_1$ to the industry is perfectly elastic, but the price of factor $X_2$ is an increasing function of the amount of $X_2$ employed. Let $x_1$, $x_2$, and $y$ denote quantities of $X_1$, $X_2$, and $Y$ respectively.

1. Write down a production function for $Y$ and derive its isoquant equation. Draw a diagram showing at least two isoquants $y_0$ and $y_1$ for a typical firm on $x_1$ $x_2$ axes. Be sure to indicate whether the assumptions above dictate any special shapes of or relations between these isoquants. Explain.

2. On the same diagram, for a pair of factor prices $w_1$, $w_2$, sketch an expansion path showing the cost minimizing input bundles as output increases. Be sure to indicate whether assumptions indicate any special shape of the expansion path. Explain.

3. On a separate diagram, draw the marginal and average cost curves corresponding to the factor prices and expansion path in (b). Be sure to indicate whether the assumptions dictate any special shape of these cost curves. Explain.

4. Describe the industry’s supply function for $Y$ for a time period in which $X_1$ and $X_2$ are variable but the number of firms is fixed.
Section II – Managerial Economics

**Question 1.** Hypermarts have become common in many countries but are less common in the United States. One such hypermarket is MINKA or Primer Multimercado del Peru which is located in Lima, Peru. It is located near the main bus line in Lima which is a city of 18 million people. It sells meat, used cars, fresh produce, fresh fish, clothing, auto parts, pharmaceuticals, and has about everything you can think under one roof. The store was built inside an old airplane hangar. Yet, we have nothing similar to this in the United States.

1. What are the possible economies of scale in such hypermarkets?

2. What are the possible diseconomies of scale?

3. Why do we not see such hypermarts in the United States?

**Question 2:** In his pathbreaking book *Competitive Strategy*, Michael Porter introduced five-forces framework for exploring economic factors that affect profits in an industry. Ever since, Porter’s five-forces have shaped a generation of academic research and business practice. You are asked to explain and apply Porter’s five-forces framework in the following questions.

1. Describe the five-forces framework. What role, if any, the economies of scale and scope in an industry play in determining the strength of each of the forces.

2. What are the major limitations of the five-forces framework?

3. Now consider the breakfast cereal and its grain supplier industries. Breakfast cereal is one of the most profitable food industries in the US including the major producer companies such as General Mills, Kellogs and Post. However, the supplier industry, which comprise wheat, oat and food-grade corn farmers, is not so profitable. Use five-forces framework to explain this disparity. Can you think of other explanations?
**Question 3.** The “make or buy” decision is a critical one for a firm and one that has received three Nobel Prize awards in economic sciences. The following diagram can be used to help describe how a firm decides to make or buy. The retail grocery supermarket segment of our food economy has become concentrated in recent years with Wal-Mart, Target, CostCo and others who have vertically integrated backwards into the wholesale grocery business and integrated the purchasing function from grocery manufacturers as well as supply chain logistics of shipping the product directly from manufacturers to retail grocery stores.

A. Using the following diagram and your knowledge of the broad food economy value chain, describe specific reasons using terms from the diagram why these firms have integrated into wholesaling as a key competitive advantage. In doing so, you should also discuss why the market was not able to handle this issue.

B. Despite the rapid consolidation in retail grocery supermarkets, there still remains a small but viable independent grocery segment composed of firms with less than ten stores and are owned primarily by families. They have not vertically integrated but use the market to procure their products. General Mills is one of the world’s largest grocery manufacturers and owns many dry packaged food goods brands such as Hamburger Helper, Green Giant, Big G breakfast cereals, etc. They have recently launched a program that is designed to form an alliance with these independent grocers by managing their inventories. General Mills says if these stores turn over the inventory ordering process to General Mills, they will be able to save these grocers significant money because their databases understand local demand much better than the grocers do. Yet, there has been little interest in such a program. Again, using the diagram and your knowledge of the food economy describe specific reasons why such a program makes sense to General Mills but makes little sense to these grocers.

C. There are several large wholesale grocery cooperatives that are owned by independent retail grocers (Wakefern, AWG, etc.) and have been quite successful. Given your knowledge of cooperatives and the food economy, use the diagram to discuss reasons why these wholesale grocery cooperatives have been successful. Remember a cooperative is not strict vertical integration (“make”) but has an ownership dimension that is different than an alliance, etc.
Are there existing suppliers that can attain economies of scale that an in-house unit could not attain? Do they possess execution capabilities that an in-house unit would not?

Is there significant relationship-specific assets? Are there significant coordination problems? Are there significant problems involved in leakage of private information?

Would “intermediate” arrangements (alliances, close-knit supply arrangements) suffice?

Is detailed contracting infeasible or too costly?

Is common ownership needed to mitigate contracting problems?

Alliances, joint ventures, or other close-knit non-ownership arrangements

Vertical Integration

Use the Market