Ph.D. Core Examination

PRICE THEORY (MICROECONOMICS)

Friday, July 8, 2011

WRITE in **black ink** and write only on **one side** of each page.

DO NOT WRITE in the margins.

Be sure the "random number" stamped on your paper is the correct number (the number you were given by the department office). Be sure to put your **random number** in the upper left hand corner of **every page** you write on.

On the **first page** of your examination write:

- the name of the examination
- the date of the examination

Put the **page number** in the upper right hand corner of **every page** of your examination.

When you have completed your examination, write the **total number** of pages on the **back** of the last page.

Put your examination in the envelope to be turned in.

Results of the examination will be posted by your random number outside the Office of Graduate Student Affairs and sent to you by letter.

TIME: THREE HOURS

1. **You must answer ALL questions and justify ALL answers.**
2. **The exam is out of 180 points. Part I is worth a total of 90 points. Each of Parts II, III, and IV are worth 30 points.**

Note: The envelope you will be given will contain a colored writing pad to be used for notes and a white writing pad with your random number to be used for writing your final answers.

Prelim 2011

I. BASIC PRICE THEORY QUESTIONS (90 points)

Answer each of the following ten questions as TRUE, FALSE, or UNCERTAIN, and justify your answer. Each question is worth 9 points. Your grade will depend entirely on your justification.

1. A factor neutral rise in productivity by 2% in both the market and household sectors will raise real full income by 2%.
2. Assume parents are altruistic to children, and that parents and children overlap when their children are young adults and also middle aged. The altruism of parents will increase the consumption of young adults and reduce the consumption of the middle aged.
3. The US government has proposed to subsidize new hires by firms in order to reduce unemployment. It will reduce unemployment but not by a lot.
4. An increased supply of new college graduates will induce an increase in physical capital, a reduction in the earnings of recent college graduates, and an increase in the earnings of less recent college graduates.
5. Various governments have recently coordinated a release of oil onto the oil market from their strategic oil reserves. This will have no effect on oil prices since it will simply induce a compensating increase in oil reserves held by the private sector.
6. A per unit tax on a monopolist will reduce the monopolist's profits by less than the amount of revenues collected by the government since the monopolist will pass some of the tax on to consumers in the form of higher prices.
7. Labor augmenting technical progress will increase the demand for labor more in the long-run (when capital is variable) than in the short run (when capital is fixed).
8. An increase in the rate of technical progress in the production of semiconductors will cause the use of semiconductors to rise in the long-run but fall in the short-run when the supply of semiconductors is very elastic.
9. If rates of technical progress differ across sectors but are constant over time within sectors then the growth rate of aggregate output will tend to increase over time as more rapidly growing sectors account for a larger and larger share of output.
10. An increase in the efficiency of household production that is factor neutral between goods and household time (holding market productivity constant) will reduce the amount of time devoted to market production.

Price 2011

II. DEMAND THEORY AND GENERAL EQUILIBRIUM PROBLEMS (30 points)

Each of the five questions below is worth 6 points.

Questions 1, 2, and 3 concern the utility function $u(x_1, x_2) = \min\{2x_1, x_2\}$ defined on $\mathbf{R}^2_+$.

1. For non negative prices (p_1, p_2) and income I compute the demand function $x(\bullet)$ generated by u.

2. For the utility level $u = 5$ determine the Hicksian compensated demand function for the first commodity $H_1(\bullet, 5)$ associated with the utility function $u(\bullet)$.

3. Define the substitution term $\sigma_{11}(p_1, p_2, I)$ that is associated with a general demand function $x(\bullet)$ for two commodities. For $u = 5, p_1 = 1$, and $p_2 = 2$ and the function H_1 determined in 2., state a relationship between $\partial H_1((1,2),5)/\partial p_1$ and the substitution term $\sigma_{11}((1,2),I)$, where I is the minimum expenditure needed to achieve $u = 5$ when $p_1 = 1$ and $p_2 = 2$. Verify that this relationship is satisfied at $((1,2),I)$.

Questions 4 and 5 concern an Edgeworth Box Economy E in which the first consumer has the utility function $u_1(x_1, x_2) = \min\{2x_1, x_2\}$, the second consumer has the utility function $u_2(x_1, x_2) = x_1 x_2^2$, the first consumer's initial endowment is 1 unit of commodity 2, and the second consumer's initial endowment is 1 unit of commodity 1.

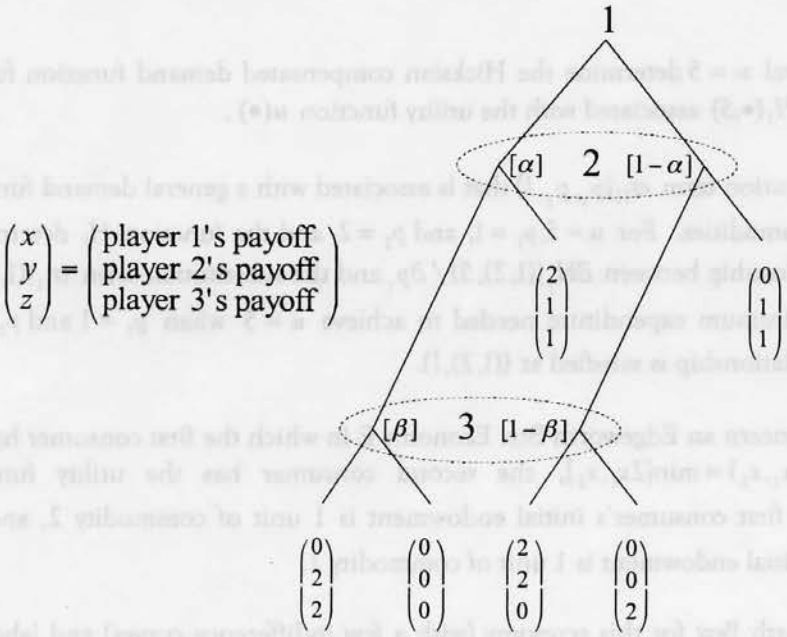
4. Draw the Edgeworth Box for this economy (with a few indifference curves) and label the endowment vector. Sketch the offer curves.

5. Identify <u>all</u> Walrasian equilibrium prices and allocations for E. Explain.

Peru 2011

III. GAME THEORY (30 points)

This question concerns the extensive form game depicted in the figure below in which each of three players, players 1, 2, and 3, has two choices, "Right" and "Left, " when it is his turn to move. The notation α denotes the probability that player 2 (when it is her turn to move) assigns to player 1 having chosen Left, and β denotes the probability that player 3 (when it is his turn to move) assigns to player 1 having chosen Left and player 2 also having chosen Left. Justify all answers.



(a) (10 points) What is the relationship between α and β in any sequential equilibrium?

(b) (10 points) Find an assessment that is sequentially rational and satisfies Bayes' rule, but is not a sequential equilibrium. Prove that the behavioral strategy component of your assessment is a subgame perfect equilibrium.

(c) (10 points) Argue that in any sequential equilibrium, player 1 must use a mixed behavioral strategy. What must be the values of α and β in any sequential equilibrium?

PRU 2011

IV. INFORMATION-ECONOMICS QUESTION (30 points)

A class of entrepreneurs have projects that require a cash investment of $K = 5$ from a banker.
A project would return $R = 13$ if it succeeds, but it would return 0 if it does not succeed.
A project also requires a personal investment of time and resources by the entrepreneur, but the entrepreneur can choose whether to make a low or high personal investment in the project.
The entrepreneur's cost of a high personal investment is $c_H = 2$. The probability of the project succeeding is $p_H = 0.75$ when the entrepreneur's personal investment is high.
The entrepreneur's cost of a low personal investment is $c_L = 1$. The probability of the project succeeding is $p_L = 0.50$ when the entrepreneur's personal investment is low.
As a contractual condition for receiving the bank's investment, a banker can require that the entrepreneur must make at least a low personal investment, which is observable.
But a banker cannot require higher personal investment by an entrepreneur, because the difference between low and high personal investment by the entrepreneur cannot be observed by anyone else. (Its effect on the probability of the project succeeding is its only observable consequence.) Assume that entrepreneurs and bankers are risk neutral, but an entrepreneur cannot be required to pay anything back if the project fails. Ignore any time discounting (that is, assume that any risk-free alternative investments for a banker's funds would pay 0 interest).

Consider first the case where there is just one entrepreneur and one banker with K=5 to invest, and the banker can specify the terms on which she would invest.
The banker can offer to invest K=5 in the entrepreneur's project in exchange for contractual requirements that the borrowing entrepreneur must make at least a low personal investment and then must repay some amount D if the project succeeds. (Nothing can be repaid if it fails.)
The repayment amount D that the banker specifies may be called her price for the loan.
If the entrepreneur accepts the banker's offer and if the project succeeds, then the entrepreneur would get to keep the remaining funds R−D.

(a) (10 points) Show the inequalities that the loan-price D must satisfy for the entrepreneur to have an incentive both to accept the loan and to make a high personal investment, and for the banker to get nonnegative expected profit from financing the project with such a high personal investment by the entrepreneur. What is the range of loan-prices D that satisfies these inequalities?

(b) (8 points) What is the highest loan-price D for which the entrepreneur would be willing to accept the loan and make at least a low personal investment? What would be the banker's expected profit from offering to invest at this highest acceptable loan-price D?

(c) (8 points) What is the optimal loan-price D that yields the highest possible expected profit for the banker? Compute the maximal expected profit that the banker can get with this optimal D.

(d) (4 points) Now suppose that there many such entrepreneurs, and there are several bankers who can lend to these entrepreneurs, but the bankers' total supply of investable funds is much less than the total that the entrepreneurs could invest. What terms for loans would you expect the bankers to offer in this market?

Prof 2011