

Department of Economics. Harvard University. Spring 2011

Honors General Exam

April 6, 2011

The exam has three sections: microeconomics (Questions 1–3), macroeconomics (Questions 4–6), and econometrics (Question 7). Each section of the exam is of equal point value. Thus you should spend roughly 1 hour on each section of the exam.

You must answer ALL questions on the exam.

You must use a SEPARATE bluebook for each question, so you will hand in seven (7) bluebooks. Make sure your name and the question number are on the outside of each of the bluebooks! The number should refer to the actual question number on the exam.

You can bring one calculator, but no notes are permitted.

Good luck!

Microeconomics (60 points)

Question 1: Game Theory (20 points)

- (a) You and a friend are discussing two games: 1) a simultaneous move game; and 2) a sequential move game with the same payoff structure, but where one player gets to move first. Your friend says:

Any outcome that occurs as a Nash equilibrium of the simultaneous move game is also a plausible equilibrium outcome of the sequential move game.

Decide whether your friend's statement is true or false. If the statement is true, explain why; if it is false, provide a counterexample. Your grade depends on the quality of your explanation. (8 points)

- (b) Study the following game:

		Player 2		
		L	M	R
Player 1	T	2, 3	1, 0	5, 1
	B	1, 0	3, 3	2, 1

- Identify the dominant strategies in this game, or explain why none exist. (2 points)
- Identify the pure strategy Nash equilibria of this game, or explain why none exist. (3 points)
- Consider mixed strategies for player 2 that assign positive probability to exactly two pure strategies. Is there any mixed strategy of this form that dominates the remaining pure strategy? Identify all pure strategies that can be combined in this way, or explain why no such combination exists. (7 points)

Question 2: General Equilibrium (20 points)

Consider an economy with two agents: Alberto and Carla. Both agents like books and wine, with utility functions given by

$$U_A(B_A, W_A) = B_A + 2\sqrt{W_A}$$

and

$$U_C(B_C, W_C) = B_C W_C,$$

where B_A , W_A , B_C , and W_C denote Alberto and Carla's consumption of books and wine, respectively. Alberto has an endowment of 16 books and 3 bottles of wine, while Carla has an endowment of 4 books and 10 bottles of wine. Throughout, you may ignore any complications created by "corner" solutions.

- (a) Consider depicting this economy in an Edgeworth box. Derive a formula for B_A in terms of W_A that traces out the set of Pareto optimal allocations. (4 points)

The remainder of this problem walks you through solving for the competitive equilibrium of this economy. In doing so, make books the numeraire good, and fix the price of books to be 1. Let p denote the price of wine. Assume that both agents take prices as given.

- (b) Solve for Alberto's demand for books and wine. (4 points)
- (c) Solve for Carla's demand for books and wine. (3 points)
- (d) In equilibrium, total quantity demanded must equal total quantity supplied. Use this fact, along with your results from parts (b) and (c), to write down two equations that must be satisfied in competitive equilibrium. Solve for the equilibrium price p and for each agent's equilibrium consumption bundle. (5 points)
- (e) Now, suppose that Alberto's endowment of books increases. Show that the relative price of books and wine will remain unchanged. Do you believe that this is a general result in an exchange economy? Explain why or why not. (4 points)

Question 3: Imperfect competition (20 points)

Consider an industry with two firms. If a firm chooses to produce nothing, its cost is zero. When producing positive quantities, the firms' costs are given by

$$c_1(q_1) = q_1^2 + 20,$$

and

$$c_2(q_2) = 2q_2^2 + 4,$$

where q_i is firm i 's chosen quantity.

- (a) For what range of output levels does firm 1 have a lower marginal cost? For what range of output levels does firm 1 have a lower average cost? (5 points)
- (b) Suppose that demand in this industry is perfectly elastic at a price of 6 (so both firms behave as price takers). How much will each firm supply? How much profit will each firm make? (5 points)
- (c) Suppose that the market demand curve for this industry is

$$Q = 92 - P,$$

and that the firms engage in Cournot competition (i.e. they simultaneously set quantities). How much will each firm supply, and how much profit will each make? (5 points)

- (d) Keep using the market demand curve from part (c), but now suppose that the two firms decide to collude and maximize their joint profits. How much will each firm supply? (5 points)

Macroeconomics (60 points)

Question 4 (20 points)

This question asks you to use some mathematical formulas to model output-per-worker in an economy. In all questions below, assume that the economy in question is a closed economy with no government. Output consists only of consumption and investment.

- (a) Assume that there are two types of productive factors in the economy, physical capital K and labor L . Technology E is assumed to be labor-augmenting, so that as E grows, L becomes more productive. Write down a Cobb-Douglas, constant returns to scale production function that shows how these factors could be combined to produce aggregate output, Y . (4 points)
- (b) What term(s) in your production function determine(s) the share of total output that is earned by physical capital, K ? How large is this share likely to be in practice? How would the capital share change if the stock of physical capital were suddenly reduced, say, by a war that left labor L and technology E unaffected? (4 points)
- (c) Derive an expression for the marginal product of capital MPK in your economy. How would the marginal product of capital change if a large amount of capital were to be destroyed in a war or other disaster that left labor and technology unaffected? (5 points)
- (d) After a war or disaster that destroyed some capital without affecting labor or technology, would you expect output per worker $\frac{Y}{L}$ to grow faster or slower compared to the period before the disaster? You should assume that growth in labor L occurs at the constant, exogenous rate n , and that technology E grows at rate g . Neither of these growth rates are affected by the disaster. Further, the saving rate both before and after the disaster is constant at s , so that total savings in the economy is sY at all times. In each period, a percentage δ of the physical capital stock wears out due to depreciation. As you answer this question, be sure to explain your reasoning. Pay particular attention to the way in which your answer may depend on assumptions about the initial position of the economy, relative to long-run trends, at the time that the war or disaster occurs. (7 points)

Question 5 (20 points)

Why should institutions matter for the production of output, and how can one show the importance of institutions (in particular over geography) in explaining long-term differences in per-capita GDP? (To receive full credit please make sure to provide relevant examples.)

Question 6 (20 points)

Suppose that net national wealth dropped by \$10 trillion due to a \$5 trillion fall in the market price of equities and a \$5 trillion fall in the market price of housing.

- (a) How would this drop in asset prices affect annual household consumption? Please quantitatively estimate the aggregate change in household consumption. In other words, what is your best estimate of the dollar amount that aggregate household consumption would change? Please explain the modeling assumptions that you make. What economic theories are you employing to generate your analysis? (10 points)

- (b) Now suppose that in addition to the \$10 trillion drop in net national wealth, current annual labor income fell by \$1 trillion. How would the fall in labor income affect household consumption? Does it matter whether the fall in labor income is permanent or transitory? Again, please explain the modeling assumptions that you make. What economic theories are you employing to generate your analysis? What assumptions are you making about credit markets? (10 points)