

# Intermediate Microeconomics - Spring 2016

Mark Dean

Homework 5

**Due** Wednesday 2nd March

**Question 1 (Pareto Efficiency)** Consider the economy and endowments described in Question 1 of Homework 4

1. Show that the equilibrium of the economy is Pareto efficient (show directly - do not invoke the FFTWE)
2. Show that it is not Pareto efficient for Geoff and Stelling to consume their endowments (sometimes called autarky)
3. Show that it is not Pareto efficient for both Geoff and Stelling to receive half of the total available cod and tanning oil

**Question 2 (Gains from Trade)**<sup>1</sup> Here are two questions which examine whether people are always made better off by trade

1. Show that, in any economy, no-one strictly prefers the autarky situation (where everyone has to eat their endowment) to the equilibrium (i.e. either the equilibrium pareto dominates autarky, or everyone is indifferent between the equilibrium and autarky)
2. Consider an economy with two consumers, Joseph (1) and Gordon (2) and two goods (armadillios ( $a$ ) and bandanas ( $b$ )). Preferences for the two consumers are given by

$$u^1(x_a^1, x_b^1) = \ln x_a^1 + \ln x_b^1$$

$$u^2(x_a^2, x_b^2) = \ln x_a^2 + \ln x_b^2$$

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<sup>1</sup>Thanks very much to Teck Tan for this question

And the endowments by

$$w_a^1 = 0$$

$$w_b^1 = 2$$

$$w_a^2 = 2$$

$$w_b^2 = 2$$

- (a) Calculate the equilibrium of this economy
- (b) Now assume that the economy consists of three people: Joseph, Gordon and Levitt
- (3). Levitt's preferences are given by

$$u^3(x_a^3, x_b^3) = \ln x_a^3 + \ln x_b^3$$

And his endowment is given by

$$w_a^3 = 2$$

$$w_b^3 = 0$$

- (c) Calculate the equilibrium of this economy. Are Joseph and Gordon made better off by allowing Levitt to trade with them?

**Question 3 (Externalities)** Consider the example from the end of Lecture 9. Ethel and Gwen start off with 5 slices of toast each. There are 10 cigarettes that can be either smoked or not. Ethel's utility is given by

$$u^1(x_c^1, x_t^1) = (x_c^1)^3 x_t^1$$

while Gwen's is given by

$$u^2(x_c^2, x_t^2) = (10 - x_c^2) x_t^2$$

1. Show that it is not Pareto optimal to completely ban smoking (i.e. set  $x_c^1 = 0$  and each person eats 5 slices of toast)
2. Show that it is not Pareto optimal to allow Ethel to smoke all 10 cigarettes (i.e. set  $x_c^1 = 10$  and each person eats 5 slices of toast)
3. Consider a market solution in which Gwen has the right to not allow smoking, but can sell the right to smoke cigarettes to Ethel at the price  $p_c$  per cigarette (the price of toast is normalized to 1)

- (a) Set up the consumer problem for Ethel and Gwen, and solve for their demand functions as a function of  $p_c$
- (b) Solve for the equilibrium of the economy
- (c) Show that this equilibrium is pareto optimal (show this directly - do not just invoke Coase theorem)