Int. Micro Problem Set 5 and Reading Assignment

First, what you should be reading.

Chapter 11 on Tax incidence. Then all of Chapter 12 *except* for Section 12.3 (on "The Welfare Economics of Time and Uncertainty").

Next week (after Thanksgiving) I will be into Chapter 13. You should read at least some of that chapter as well over the Thanksgiving Break.

Next, your problem set. Do Problems 12.1.–12.5, 12.7, 12.9 and then do the exercises below (these are not really problems but a step-by-step way of going over what I done in class). Next, do problems 13.1–13.5.

The Problem Set is due on Thursday, December 2, by the end of class.

This extra set of exercises is meant for you to understand how Edgeworth boxes work, both for final goods and also for factors of production. Note: Each time I ask you to draw a figure please draw the *entire* figure again. Do not fill material into a previous figure.

[1] Suppose that there are two factors of production, L and K, and that their quantity is in fixed supply. There are also two output, A and B, which can be produced with these inputs. Draw the Edgeworth Box (with L horizontal and A on the bottom-left corner), and make sure you label all relevant axes and corners.

[2] Now draw isoquants for both A and B and notice the close parallel so far to an Edgeworth boxes with final goods (and individuals).

[3] Pick any production level for A, and any production level for B, pick any set of factor prices, and show in the box the two cost-minimizing points for production of A and B.

[4] Show that, in general, if you add up the required input use for both A and B in the exercise in [3], these will not exactly add up to the total supply of inputs (dimensions of the box). But notice that this problem goes away when you choose the isoquants to be mutually tangent to each other.

[5] Show very carefully that all the points of mutual tangency of isoquants are precisely the *efficient points*: starting from any such point, you can never go to another in which *both* outputs are higher. Moreover, starting from any point which is *not* a point of mutual tangency of isoquants, you can go to another in which both outputs are higher.

[6] Combine [4] and [5] to show that cost-minimization plus feasibility (input demand equal to input supply) is enough to give you efficiency!

[7] How does the price system guarantee that the input choices made by individual firms are indeed feasible? By using profit maximization. Go back to the Edgeworth box, draw the entire locus of efficient points and use these to form a *production possibility frontier* (PPF). The next few questions will bring in profit maximization.

[8] Examine the slope of the PPF, drawn with A on the horizontal axis. This is the rate at which A can be traded off for B, the *marginal rate of transformation* between A and B. It is

just equal to $-\frac{\Delta B}{\Delta A}$, the gain in B (ΔB) divided by the loss in A (ΔA). Show that this ratio is precisely equal to $\frac{MC_A}{MC_B}$, the ratio of *marginal costs*.

[9] Now using [8], and what we know about profit maximization, show that for any given price ratio p_A/p_B, the appropriate point on the PPF will be chosen so that this ratio equals the slope of the PPF at that point. This is how the market system pins down production levels.

[10] Here is another way to think about problem [9]. Imagine for a moment that both production of A and B are controlled by the same firm. Then, given any set of prices (p_A, p_B), we can draw a family of iso-revenue lines (combinations of A and B that give the same level of revenue $p_A A + p_B B$). Draw some of these lines on a diagram with A and B on the axes and sketch in the PPF as well. Now find the point on the PPF which gives the highest revenue. Note that this is exactly the same point as in [8].

[11] Now let us put together what we have learnt so far. Given a PPF and some price ratio, we know the point that will chosen for production on the PPF. Do two things. First, find that combination of isoquants inside the (input-based) Edgeworth box, note that they are mutually tangent (because the production point is efficient), and notice that the price ratio of *inputs* musut be equal to the common slope of the isoquants. Second, go back to the PPF, and create an Edgeworth box — this time for goods — with dimensions equal to the chosen production levels. Now it is as if we are in an exchange economy, with two people and two goods.

[12] Given the shares of these two people in production activity and the amount of labor and capital then own, we can determine endownment points (initial rights to A and B) for each person. Show diagrammatically the competitive equilibrium of this exchange economy. This will give us a price ratio at which supply is set equal to demand in the goods market.

[13] Now notice that consumers and producers face the *same prices*. It follows that in a *full competitive equilibrium for the entire economy*, the price ratio derived in [12] must be the same as the price ratio that we started off with, to choose the point on the PPF. Use this to argue that in a full competitive equilibrium, (a) the marginal rates of substitution between goods A and B are equalized over all individuals, no matter what their preferences look like (as long the usual assumptions such as convexity are satisfied), (b) the marginal rates of technical substitution between K and L are equalized over different production sectors, and (c) the common MRS in part (a) is, in turn, equalized to the marginal rate of transfor,mation between A and B.

[14] Why does this equalization (of marginal rates) make for Pareto-optimality? You have already seen this in class for equality of MRS across *people*. Now ask yourself, why should this (equalized) MRS also be equalized to the marginal rate of transformation between A and B? Show that if this equality does not hold, society can develop an alternative allocation of production and consumption which will make both indivdiuals better off.