Dr. Wilcox. Micro I. Problem Set #2.

(1) In class, we did the general comparative statics for a supply and demand system affected by a per-unit tax. Suppose that everything is as it was when we did that in class (that is, $q_s = S(p_s)$, $q_d = D(p_d)$ and $p_d = p_s + \tau$, but do not assume that the supply function slopes up. Instead assume that the supply and demand functions are long-run functions, and that the industry in question is a "decreasing cost industry." Using any undergraduate intermediate micro theory text, remind yourself of what that is, and explain in your own words what that is (WARNING: It has NOTHING to do with the shape of any firm's ceteris paribus relationship between its own output and its own cost--that is, the shape of the individual firm's average cost curve). Now do the same general comparative statics exercise formally for the effect of a change in τ on $p^e{}_d$. Distinguish between two cases concerning the relationship between the absolute values of the derivatives of supply and demand near the equilibrium, and describe the different results you get in those two cases. Discuss the reasonableness of the two cases from the viewpoint of the stability of the equilibria in these cases according to the concept of Marshallian (NOT Walrasian!) stability. (There are sections in Silberberg and Nicholson on Walrasian and Marshallian concepts of stability of supply and demand equilibrium.) Then describe intuitively why these two cases are different by thinking about whether there are reasonable paths by which the industry might have grown to any initial equilibrium in the two different cases--reasonable in terms of the incentives of starting firms to enter the industry when the whole industry is just starting out at small (that is, way below long run equilibrium) scale.

(2) (From Nicholson, page 574, problem 18.2, a and b only). A monopolist faces a market demand curve given by $q_d = 70 – p_d$.

(a) If the monopolist can produce at constant average and marginal costs of AC=MC=6, find the profit-maximizing output level, price and resulting maximum monopoly profit of the monopolist. (Some hints: When average and marginal costs are both equal to some constant α, as in part (a) of this problem, the total cost function is $C(Q) = \alpha Q$. The problem will be easier if your very first step is to convert the demand function into an inverse demand function—the reason being that you want to eventually express both total revenue and total cost as functions of only Q, so as to make total profit depend only on Q).

(b) Now suppose that the monopolist's total cost is given by $C(Q) = 300$ for all $Q \le 10$ and $C(Q) = 0.25Q^2 - 5Q + 325$ for all $Q \ge 10$. Find the profit-maximizing output level, price and resulting maximum monopoly profit of the monopolist. Also: Would the profit maximum have been different if we just assumed that $C(Q) = 0.25Q^2 - 5Q + 325$ for all Q? If so, why didn't I just give you that cost function (that is, is there something "wrong" with that cost function)?

(3) Return now to Problem 3 in Problem Set #1, where you set up objective functions for a monopolist facing various sorts of taxes and such, and then wrote out the monopolists' first- and second-order conditions for a profit maximum. Now I want you to do comparative statics analyses of the effects of changes in these taxes and such on the monopolist's output decisions. I also want you to figure out what the resulting effect on the prices charged by the monopolist will

be. In each case, answer any other questions as requested. Some of this is, quite frankly, totally obvious without doing formal comparative statics. But that's sort of the point of the exercise: You should know by economic intuition what these effects are, so this exercise will help to make you confident that the comparative statics method really works.

Assume throughout that, at the value of *Q* where you are analyzing the behavior of *Q* with respect to changes in whatever it is you're looking at, profits are strictly positive. This occasionally rules out discontinuities in your solution functions (why?) and rules out dumb cases where the firm can't profitably produce anything anyway.

In all cases, the request "sign its derivative" means: Use the comparative statics recipe to decide whether the derivative of the solution function is greater than, less than, or equal to zero--if it is possible to do that. The answer that "the derivative cannot be signed" is permissible—if that is in fact true—but making that argument is always a bit harder.

B. The government takes a fraction $\rho \in [0,1]$ of the monopolist's profit each year (that is, there is a pure profit tax rate of ρ). Hypothesize a solution function $Q(\rho)$ and sign its derivative.

C. The government requires that, during any year that the monopolist produces any output, she must pay a license fee *F* that is independent of the amount of output she sells. Hypothesize a solution function $Q(F)$ and sign its derivative.

The government requires that the monopolist pay t dollars every time it sells a unit of its product (that is, the government imposes an excise tax of t dollars per unit sold by the monopolist). Hypothesize a solution function $Q(\tau)$ and sign its derivative.

E. The government allows the monopolist to keep any dollar price p_s per unit she likes, but requires that the monopolist collect a dollar price $p_d = (1+t)\, p_s$ per unit from buyers and turn over tp_s dollars to the government for every unit sold. Hypothesize a solution function $Q(t)$ and sign its derivative.

F. Throughout these problems, $C(Q)$ was the cost of production of Q total units of <u>salable</u> output; that is, units produced were always free of defects and hence could be sold. Suppose instead that a <u>gross</u> output of Q_g total units of the product is produced at a cost given by a new function $G(Q_g)$ which is continuous, twice differentiable, strictly increasing and convex, and also assume that $G(0) = 0$. Only a fraction $\gamma \in [0,1]$ of the gross output Q_g is salable (that is, free of defect), whereas a fraction $1-\gamma$ is defective and cannot be sold at any price. That is, salable output Q is equal to γQ_g, and Q_g costs $G(Q_g)$. Express the cost of salable output $C(Q)$ in terms of Q_g, γ and the function G; write profits in terms of the inverse demand and this expression for $C(Q)$; and solve the problem that way. Hypothesize a solution function $Q(\gamma)$ and sign its derivative.