

Final Examination
Economics 440: Public Finance
Prof. Jonathan B. Hill
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Instructions: Use a Blue-Book: print your name and ID. Numerical answers *without* equations are scored *zero*. You have 3 hours. The exam is worth 130 points. Good luck!

1. (25) Answer “true”, “false” or “uncertain” to each statement, and give a brief, concise supporting argument for your answer. You cannot receive points if you do not provide an argument/reason (*if a graph(s) or equation(s) are required, no points will be given without the graph(s) or equation(s)*).
- a. A tax that generates zero tax revenues generates zero excess burden.
 - b. The Laffer curve presumes consumption /leisure preferences in which the substitution effect dominates.
 - c. A net saver who faces an increase in the tax rate on returns will save more if the income effect dominates.
 - d. A corporation favors any tax deduction scheme which allows accelerated depreciation.
 - e. Suppose firm *A*'s output causes a negative externality on firm *B*. Firm *A* it will never agree to produce less than its profit maximizing level.
 - f. In a market setting, as elasticity falls so does excess burden.

2. (25) Consider the paint industry. Suppose the paint market is perfectly competitive, and consider any one firm "*F*" with the following technology:

$$MPC = 10 + Q^2 \text{ (marginal private cost = MC for the firm)}$$
$$MB = 35$$

A local community assessed the following value of damage based on the number of cans of paint:

$$MD = .5 \times Q^2$$

- a. (6) Solve for the firm's optimal level of output Q_1 . Write the firm's objective, and plot the equations with the optimal value.
- b. (6) Write out the equation for MSC (marginal social cost). Find the socially efficient level of output Q^* , plot MSC and denote Q^* , on the *above* graph.
- c. (6) Assume bargaining costs are zero (no court costs, no travel costs, all information is available, etc). Prove with *equations and graphically* (both) that if *F* has clear property rights then the community will pay it to lower its production to Q^* .

Show graphically how much *F* will be compensated in total to go from Q_1 to Q^* .
- d. (6) Now consider a public response. If the community decides to levy a unit tax *T* on firm *F*, solve for that *T* such that the firm produces exactly Q^* (this is called a *Pigouvian* tax).

3. (25) Consider an inter-temporal choice problem with utility function

$$\max_{c_1, c_2} U(c_1, c_2) = c_1^{1/5} + \frac{1}{3}c_2^{1/5}$$

The individual is endowed with $I_1 = 50,000$ and $I_2 = 10,000$. The rate of return is $r = .075$.

- a. Set up and solve the individual's optimization problem. Solve for the optimal level of savings/debt, and consumption in both periods.
 - b. Graph the inter-temporal budget constraint, denote maximum consumption levels, and the endowment point, and denote the optimal choice and IC curve.
 - c. Suppose "savings" implies any capital investment, the return on which is taxed at rate .25. Suppose "debt" denotes a mortgage loan, the interest on which is tax deductible (at the same rate). Solve the post-tax optimal savings and consumption levels, plot the new budget constraint on the same graph, above, and denote the new optimal choice.
 - d. Discuss the resulting income and substitution effects associated with part c.
4. (25) Consider a natural monopoly that produces a public utility. Assume $Q = 100 - P$ and $TC = Q^2$.
- a. Plot demand, MR, MC, AC.
 - b. Solve for the profit maximizing level of output Q_{pm} and price P_{pm} . Solve for profit. Plot everything on the graph from Part a.
 - c. Solve for the Pareto Efficient level of output Q_{pe} and price P_{pe} . Solve for the firm's profit, and compare with the profit max. outcome. Plot everything on the graph from Part a.
 - d. Now assume the government assess a user fee to compensate for the firm's lost profit, where at the profit socially efficient Q there are 100 users. What is the fee, and discuss complications with levying this fee.
5. (20) Consider a one-person (e.g. Jo) production economy in which Jo's time and effort can be used to collect/hunt apples or rabbits. The maximum number of apples available is 100, and the maximum number of rabbits is 20. Jo's present production level is 50 apples and 18 rabbit, which is on the PPF. At Jo's production level $MRT = .5$ (i.e. $1/2$), and Jo's $MRS = 1.5$ (i.e. $3/2$).
- a. Draw a standard PPF with apples on the X-axis, denote the present level of production, sketch the IC that goes through the present level, the MRS and the MRT. Be neat and complete: label everything with the proper notation and numerical values.
 - b. Is the present level of production efficient? To answer this, state the condition for efficiency (recall, there is only one person), and verify whether the condition is satisfied.
- If the level is not efficient, how should Jo change the levels of production in order to obtain efficiency?
6. (10) State the *First Fundamental Theorem of Welfare Economics*. Be sure to state all required assumptions. Give two examples in which the FFTW likely or nearly or truly holds, and two in which it cannot hold. In the latter case explain the consequences for efficiency. Be sure these are real examples which most educated people (and economists, for that matter, and ultimately the test grader!) would agree with.