



4. (20 points) Suppose that researchers want to study the effect of the consumption of Ecstasy (illegal drug) on brain damage. The following econometric equation is being estimated:  $BD_i = a_1 + a_2 E_i + e_i$ , where  $BD_i$  is some objective measure of brain damage of person  $i$ , and  $E_i$  is the monthly consumption of Ecstasy by person  $i$ ,  $e_i$  is the error term,  $a_1$  and  $a_2$  are parameters to be estimated. Suppose that regression procedure yields positive estimates of both parameters:  $a_1 = 0.5$  and  $a_2 = 1.35$  (which means that there is positive correlation in the data between brain damage and Ecstasy consumption).
- Give at least two examples of factors which the error term is intended to capture here.

- Name at least three problems with regression analysis and provide specific interpretation of these problems for the case discussed in this problem.

- Do you think other empirical methods would allow us to get “better” (more reliable) results? Carefully argue why or why not?

5. (30 points) Imagine that there are two people in one room – Mary and Jane. Mary is smoking cigarettes. The table below shows Mary’s Marginal Private Benefits ( $MPB_M$ ) and Marginal Private Costs ( $MPC_M$ ) of smoking each additional cigarette, as well as Marginal Damages ( $MD_J$ ) to Jane from each additional cigarette:

Number of cigarettes smoked	$MPB_M$	$MPC_M$	$MD_J$
1	14	5	5.5
2	12	6	6
3	10	7	6.5
4	8	8	7
5	6	9	7.5
6	4	10	8
7	2	11	8.5

- a. How many cigarettes is Mary going to smoke? Explain.
  
- b. What is the socially optimal number of cigarettes? Explain.
  
- c. What is the net welfare benefit to society from moving from output in part (a) to socially optimal output in part (b)?
  
- d. Suggest a Pigouvian tax that would induce Mary to smoke socially optimal number of cigarettes?

- e. Suppose that property rights to the air in the room were assigned to Jane. Do you think that Coase Theorem could be applied here? Explain.
- f. Do you think it makes sense to ban smoking in this room altogether? Explain.
6. (20 points) Consider two neighbors Terry and Rob. They both plan to produce fireworks on the New Year's Day. The (inverse) demand functions are given by:  
 $P_T = 50 - Q_T$ ;  $P_R = 50 - Q_R$  (quantities are expressed in number of rockets used); the marginal cost is given by  $MC = 40 = \text{const}$ .
- a. First suppose that Terry and Rob can prevent each other from watching the fireworks that each of them produces. In other words, fireworks display is excludable and is therefore a private good. What is the efficient number of rockets used by both Terry and Rob in this case? Show all your work.
- b. Now assume that it's impossible to exclude neighbors from watching and enjoying fireworks. Now fireworks display is a public good. What is the efficient number of rockets in this case? Show all your work.

- c. Define the free-rider problem. Based on your results in parts (a) and (b), comment if free-rider problem is present in this case? (If you weren't able to answer either part (a) or part (b) or both, assume that quantity in part (a) is 25 and quantity in part (b) is 35)
7. (extra credit – 5 points) State of Virginia recently came very close to passing a bill that would introduce \$50 fine for wearing pants in such a way that underwear is visible in “a lewd or indecent manner” (bill passed through state House but was rejected by the Senate). The bill would effectively prohibit wearing pants very low. Provide a justification for such a policy based on theory of externalities. Do you think this policy would lead to efficient outcome? Explain why or why not?