

14.03/14.003 Exam 3

Fall 2014

Professor David Autor

Monday, 12/15/2014

Instructions

- Please do not open this exam until directed
- There are 80 points on this exam and you have 120 minutes to complete it.
- You may not use a calculator (there is no need for it).
- No other reference material is allowed.
- There are 3 parts to the exam: please use a separate exam book for each part.
- Correct answers without explanation do not receive credit.
- Part I is SHORT ANSWER. Answer 4 problems of 6. (5 points each, 20 points total.) You must explain your answers with one or two sentences or graphs. Correct answers without explanation do not receive credit. *If you answer more than 4 questions, we will only grade the first 4.*
- Part II has 1 long question that you must answer. (30 points)
- Part III has 1 long question that you must answer. (30 points)

Part I

Short Questions: Answer 4 of 6 questions [5 points each, 20 points total]

1. True/False/Uncertain and why?: If people are worried about adverse selection in the health insurance market, then a plan of introducing more competition among many insurance providers (by, for example, forcing them to have similar plans and letting the buyers choose the cheapest) would likely solve the problem.
2. A set of risk averse consumers, each with identical preferences and identical wealth $w > 0$, faces identical independent risks of experiencing loss $w > L > 0$. True, false, or uncertain and why: There are no potential gains from trade in risk among these consumers.
3. True, false, uncertain and why: A central requirement for a valid regression discontinuity design is that the treatment and control groups are identical in every way but they are treated differently due to randomization of the ‘running’ variable (e.g., credit score, age, etc.).
4. The film studio Twentieth Century Fox once insured actress Betty Grables’ legs for \$1 million each (~\$17 million in current USD). Is this insurance arrangement likely an example of risk pooling, risk spreading, or risk transfer? Explain.
5. When hiring young lawyers, law firms attempt to screen out applicants who plan to have children during the first ten years of their career (call these applicants “family types”). This is because lawyers tend to reduce their billable hours and thus generate less profit for their law firms once they have children. True, false, uncertain or why: The *full disclosure* principle says that job applicants will explicitly or implicitly reveal their type (family type, non family type) during the interview process, and hence screening for this characteristic is not necessary.
6. State Lotteries sold \$53 billion of lottery tickets in 2010. Suppose the cost of playing is \$1 and the expected value of playing is 50 cents (i.e. $\sum_i p_i W_i = \$0.50$ where W_i is payout i , and p_i is probability of that payout). Mr. Jo, a VNM expected utility maximizer, is indifferent between playing the lottery or not. Is Mr. Jo risk-averse, risk-loving, neither, or is there not enough information to say? Explain.

Part II

Body Cameras [30 points]

Suppose that Congress approves funds for 50,000 body cameras to be used by police officers across the U.S. There are 3,000 counties in the U.S. but only enough cameras initially for 1,000 counties. To maximize effectiveness, body cameras will only be used initially in the counties with the highest crime rates as measured by homicides per 10,000 persons. Specifically, the assignment rule is:

$$C_i = \begin{cases} 1 & \text{if } H_i \geq 0.65 \\ 0 & \text{if } H_i < 0.65 \end{cases}$$

where C_i denotes whether county i is allocated body cameras and H_i is the homicide rate per 10,000 persons in county i . There are exactly 1,000 counties with $H_i \geq 0.65$. You are a grad student at MIT (sorry) and you work for David Autor (sorry). President Obama has personally asked you to evaluate the program, finding its effects on incidents of police brutality.

1. Suppose that you have data on reports of police brutality (B_i) in each county i one year after the policy was introduced. Explain carefully how you would construct a regression discontinuity estimator of the effect of the cameras on incidents of police brutality. Call this estimator T_{RD} . **(5 points)**
2. Does T_{RD} provide an unbiased estimate of the causal effect of receiving police cameras on police brutality? Explain why or why not, along with any assumptions you need to make. **(6 points)**
3. Suppose that you find $T_{RD} = -5$. President Obama thinks that this is strong enough evidence to support the expansion of the policy to the remaining counties in the U.S. Do you think that T_{RD} is an unbiased estimate of the causal effect for these remaining counties with $H_i < 0.65$? Why or why not? **(6 points)**
4. You discover another policy that varies at the threshold: counties with $H_i \geq 0.65$ are allowed to use armored police cars, whereas counties with $H_i < 0.65$ are not allowed. This policy was introduced two years before the body cameras. When will this be a problem for your estimates? Can you suggest a test to check for this problem? [Hint: you can assume that you have data on police brutality both for the years before and the years after the cameras were introduced.] **(6 points)**
5. Suppose that you find that cameras reduce the number of police arrest incidents that result in death. Some years later, many (but not all) other counties decide independently to spend the money to buy cameras. How might you use this information to estimate the value of statistical life? Would your estimate be a lower or upper bound, or neither? Explain carefully the assumptions that would need to hold for your estimate to be valid. **(7 points)**

Part III

The Market For Windmills [30 points]

To improve their homes' resale values, many Massachusetts homeowners install windmills in their backyards. High quality houses are initially worth H and Low quality houses are worth L , with $H > L > 1$. Once a windmill is installed, the home's value increases from H to H^2 or from L to L^2 .

It costs $I > 0$ to install a windmill and homeowners must get I from the First Windmill Bank. In exchange, they give the bank a fraction $s \in (0, 1)$ of the value of their homes. If an owner of a house of type $X \in \{H, L\}$ installs a windmill, the bank receives a payment of sX^2 while the homeowner keeps $(1 - s)X^2$.

Each homeowner knows whether her house is High or Low quality. First Windmill Bank cannot distinguish H from L houses but it knows that half of all houses are High quality and half are Low quality ($\Pr(H) = \Pr(L) = 0.5$). Your problem is to determine under what conditions a pooling or separating equilibrium will exist in which First Windmill gives I to homeowners who ask for it in exchange for an ownership stake s . First consider a *separating* equilibrium:

1. What is the threshold value of s above which type H will *not* wish to build a windmill (call this s_H)? What is the threshold value of s above which type L will *not* wish to build a windmill (call this s_L)? Compare s_H and s_L . Explain *why* one of the following is true: $s_H = s_L$, or $s_H > s_L$, or $s_H < s_L$. **(5 points)**
2. At a separating equilibrium, only one type of homeowner, $X \in \{H, L\}$ will choose to build a windmill. Based on your answer above, is X equal to H or L ? Assume that First Windmill Bank *knows* that only type X wishes to install a windmill. For what values of s will First Windmill Bank be willing to pay I to type X to build a windmill in exchange for payment sX^2 ? **(6 points)**
3. Write the conditions under which this separating equilibrium will exist. Specifically, what must be true so that: (1) Type X wishes to borrow at cost s to build a windmill; (2) Type X' does *not* wish to borrow at cost s to build a windmill; and (3) First Windmill Bank is willing to pay I to any homeowner who requests it in exchange for ownership stake s . **(7 points)**
4. What value of s^* would First Windmill Bank choose to maximize its profits at the separating equilibrium? What are First Windmill Bank's profits (per homeowner) at rate s^* ? **(5 points)**
5. Now consider a potential *pooling* equilibrium. What is the maximum value of s at which both H and L homeowners will wish to build a windmill (call this s_p)? Write the expression for First Windmill's expected profit (per homeowner) if it pays I to any homeowner who requests it in exchange for ownership stake s_p . When would it be willing to offer this contract (s_p) to homeowners, as opposed to offering no contract at all [Note that it would not be in its interest to offer any $s < s_p$]? **(7 points)**

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