14.75: PROBLEM SET 6

Please include stata do-file code and output for all exercises.

(1) This problem is based on Monitoring Corruption.
   (a) Research design:
      (i) Describe the research design.
      (ii) What were the main treatments used to reduce corruption? What did the author find?
   (b) Use `jperoddata.dta`Regress missing expenditures - major items in road project on Audits, Invites and Comments.
      (i) Use heteroskedastic robust standard errors. What is the audit effect?
      (ii) Cluster your standard errors instead by subdistrict. What happens to your p-value? Is the effect still significant?
      (iii) Add in audit stratum fixed effects and use the same clustering as in (ii). What do you find?
   (c) Repeat (i), (ii), and (iii) of (b) but instead use as your outcome variable Missing prices - road project.
   (d) Why does the author include Table 7?

(2) A bureaucrat can exert effort $e \in [0, 1]$ to produce a good. Effort has a cost $ce^2/2$ and is unobservable. The probability that the good is produced is e and each citizen gets $u(n)$ utility if the good is produced but 0 otherwise. One citizen is a monitor who can pay a cost $\alpha m^2/2$ to observe whether the good was produced or not and the observation is successful with probability m. If he observes the good, he pays a cost s to share the information with everyone else. If he informs everyone else, the bureaucrat gets punished $p(n)$.

   The timing of the game is as follows:
   - Monitor announces m
   - Bureaucrat chooses e
   - Payoffs are realized

   (a) What is the optimal effort of the bureaucrat?
   (b) What does the monitor choose? What is the equilibrium e?
   (c) Imagine $u(n) = 10$ but $p'(n) > 0$. In fact, let $p(n) = n$.
      (i) What might this describe?
      (ii) How does the equilbrium change in n?
      (iii) What are $m'(n)$ and $e'(n)$?
   (d) Finally, let $u(n) = 1/n$ and $p(n) = n$.
      (i) What might this describe?
      (ii) How does the equilbrium change in n?
      (iii) What are $m'(n)$ and $e'(n)$?

(3) We want to look at how competition affects quantities and bribes. Local governments are responsible for regulating and monitoring the extraction of wood within their jurisdiction. If a firm wants to extract wood, they need consent. Districts choose the number of permits to sell to firms. They take the number of permits issued by other districts as given. A bribe is essentially the price paid for a permit. They are determined in equilibrium.

Suppose that there is a function $P(Q)$ where Q is the total wood produced in the province and $P(Q)$ is the price with $P' < 0$. Then let q_{fd} be the quantity a firm f produces in district d. It costs c to extract wood (constant MC) and also a bribes b_d per log may need to be paid.

(a) What is the firm f in district d's objective function? What b_d are firms willing to pay to obtain permits?

(b) Assume that the head of each district d determines the quantity of permits to issue. Say there is a legal quota $\bar{q}$. If it chooses to allow more logging than $\bar{q}$ then it has some chance, denoted $\pi(q_d, \bar{q})$ of being detected. If the district head is detected, he loses some of the other rents that he otheriwse could have obtained by being in office, r_d. Of course, he gets paid $b_d = b(q_d)$ per permit that he gets bribed for. What is the head of district d's objective function?

(c) Substitute (a) into (b) to endogenize the bribe price to show that the district head's objective function depends on q_d, $P(\sum q)$, marginal cost and the expected loss due to detection. What is the FOC?

(d) Finally, say there are n identical districts.
   (i) What is total quantity?
   (ii) Substitute nq_d to show that

$$\frac{p-c}{p} = \frac{1}{n\epsilon} + \frac{\pi'\left(\frac{Q}{n}, \bar{q}\right) r}{p}$$

   where ϵ is the price elasticity of demand.

(e) Questions:
   (i) What happens as n increases in this market? Specifically what happens to prices and what happens to forest extraction?
   (ii) Is illegal logging a substitute or complement with other rents that the district head has access to?
   (iii) In words (not in math) explain how the model might change if firms had to bribe multiple districts to log? For example, if a firm had to bribe every district from the source of the logging to the destination, what is the relationship between n and the amount of forest extraction?

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Fall 2012