14.75: PROBLEM SET 2

Please submit your problem sets in paper, and include stata do-file code and output.

(1) Use `mitaData.dta` for the following exercise.
   (a) Generate given longitude and latitude variables x, y, construct x^2, y^2, xy, x^3, y^3, x^2y, xy^2.
   (b) Regress the log equivalent household consumption (2001) (`lhhequiv`) on *mita* (`pothuan-mita`), all polynomial terms in (a), elevation (`elv-sh`), mean slope, infants, children, adults, and boundary segment fixed effects (`bfe4-1`, bfe4-2, bfe4-3). Cluster the standard errors by district. Run the regression in 3 ways: first, for observations where the distance to *mita* boundary (d-bnd) is less than 100km, next when it is less than 75km, and lastly when it is less than 50km.
      (i) What is the coefficient on *mita*? Are the results significant at the 5% level? Interpret it.
   (c) Run the same regressions as in (b), but instead of polynomial terms in longitude and latitude, use a cubic polynomial in distance to Potosi (dpot). That is, include the first, second and third powers of this variable in the regressions. Again, cluster the standard errors by district and run the regression in 3 ways: first, for observations where the distance to *mita* boundary (d-bnd) is less than 100km, next when it is less than 75km, and lastly when it is less than 50km.
      (i) What is the coefficient on *mita*? Are the results significant at the 5% level? Interpret it.
   (d) Is there any difference between the coefficients on *mita* in (b) and (c) as well as their significances? If yes, why might there be a difference? If no, why should we expect the same?

(2) Suppose individuals pay income tax at rate τ. Moreover, assume that income y is distributed log-normally. That is, $y = e^{\mu+\sigma Z}$ where Z is a standard normal. (Hint: Notice that the mean is $e^{\mu+\sigma^2/2}$. What is the median?)
   (a) Compute the average revenue per person in the population.
   (b) An individual's consumption is

$$c = y\,(1-\tau) + \tau y_{avg} - \delta\tau^2.$$

   Justify this expression.
   (c) What is an individual's preferred tax rate if she has consumption y?
   (d) What is the median voter's preferred tax rate?
   (e) Compare the equilibrium tax rates between two societies facing parameters $\left(\mu, \sigma^2\right)$ and $\left(\mu, \sigma'^2\right)$ where $\sigma' > \sigma$. Interpret your finding.
   (f) Compare the equilibrium tax rates between two societies facing parameters $\left(\mu, \sigma^2\right)$ and $\left(\mu', \sigma^2\right)$ where $\mu' > \mu$. Interpret your finding.

(3) Show that if preferences are single-peaked, then the median voter's ideal point would win a majority of votes whenever paired against each of the alternatives. To do this, let ideal

points be located on $[0, 1]$ and let b_{median} be the median voter's ideal point. We want to compare it to alternatives.

(a) First, consider alternatives $a < b_{median}$. What happens?
(b) Second, consider alternatives $a > b_{median}$. What happens?
(c) Reflect on what you have discovered.
(d) Write down an example where preferences are not single-peaked in which some alternative can strictly defeat b_{median}.
(e) Reflect on (e).

(4) Let us imagine that we have three types of individuals in the electorate (each with same population), with the following preferences.

$$1: \quad a \succ b \succ c$$
$$2: \quad b \succ c \succ a$$
$$3: \quad c \succ b \succ a$$

(a) Simple majority:
  (i) Which policy wins a simple majority in a vs b?
  (ii) Which policy wins a simple majority in a vs c?
  (iii) Which policy wins a simple majority in b vs c?
(b) Imagine a world in which individuals all vote and they all vote truthfully. Moreover, imagine that voting happened in the following way.
First, electorate votes for policy i vs alternative j.
Second, if i wins, run i vs alternative j'. But if j wins, call j the new i and repeat.
Therefore, for a policy to win, it needs to beat all other alternatives in pair-wise simple majority run-offs.
  (i) If we implemented this voting scheme, what happens in the world with the above preferences?
(c) Imagine a world in which all individuals vote and the voting commences in the following manner.
First there is a run-off between policies a and b.
Second, voters pick between c and the winner of the first round.
  (i) If all voters vote truthfully (according to their preferences) in every round, which policy wins?
    (A) Which policy wins round 1?
    (B) Now, using that, which policy wins round 2?
  (ii) Imagine type-3 voters know that type-2 and -1 voters will vote honestly.
    (A) What is the best move for type-3 voters in round 1?
    (B) In round 2?

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