

14.75: PROBLEM SET 4

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

- (1) Use IncomeandDemocracy.dta for the following exercise.
 - (a) Plot the freedom house measure of democracy against the log GDP per capita.
 - (b) Regress the polity measure of democracy of country i in year t on previous year democracy, the lagged value of log income per capita, and controls specified in equation (1) of Acemoglu et al. (2008). Specifically:
 - (i) Run the OLS regression without fixed effects and without a time dummy. Use usual OLS standard errors. What relationship do you find between lagged log income per capita and democracy?
 - (ii) Run the OLS regression with time dummies, without fixed effects. Cluster your standard errors by country. What relationship do you find between lagged log income per capita and democracy?
 - (iii) Run the OLS regression with time dummies and fixed effects. First use usual OLS standard errors. Next use clustered standard errors. What do you find? Compare the results and also contrast them with (i) and (ii).
 - (c) Conduct an IV regression using the measure of democracy in country i in year $t - 2$ as an instrument for the change in democracy in country i between years t and $t - 1$, and similarly for log GDP per capita. (That is, use $d_{i,t-2}$ as an IV for $\Delta d_{i,t}$ and $y_{i,t-2}$ as an IV for $\Delta y_{i,t}$.) What do you find? Contrast your results with those in (b).
- (2) Assume that there is a production function

$$y = k^\gamma.$$

After tax income is

$$y(1 - \tau).$$

Each year, society invests a fixed share α and consumes the rest.

$$i_t = \alpha y_t (1 - \tau).$$

Suppose there are two periods and the dictator survives to period 2 with probability p . The dictator's payoff is tax revenue. Finally, assume $k_1 > 1$.

- (a) What is k_2 ?
- (b) What is the dictator's objective function?
- (c) Derive a (potentially implicit) expression for the optimal tax rate.
- (d) Analysis. (*Hint: You can analyze things implicitly with the implicit function theorem.*)
 - (i) What is the relationship between the chosen tax rate and the initial capital stock? Interpret.
 - (ii) What is the relationship between the chosen tax rate and the survival probability? Interpret.
 - (iii) What is the relationship between the chosen tax rate and the investment share? Interpret.
- (e) Now assume $y = k$. Furthermore, assume that the dictator can choose what share to invest, α , but this is fixed across both periods. Therefore α is a choice variable. However, there is a cost to investing a higher share, represented by $-c\frac{\alpha^2}{2}$.

- (i) What is the dictator's objective function?
 - (ii) What is the optimal choice of (τ, α) ?
 - (iii) Interpret what you discovered and contrast it with what you learned from (a)-(d).
- (3) Assume that there are two groups of people: rich and poor, with proportions δ and $1 - \delta$, respectively. Let $\delta < 1/2$. We assume that the rich folk take an α share of society's income. A rich person has $y_R = \alpha \frac{\bar{y}}{\delta}$ and a poor person has $y_P = (1 - \alpha) \frac{\bar{y}}{1 - \delta}$. Moreover, taxes are rebated lump-sum equally to everyone (a la the Meltzer-Richards median voter model). Therefore, post-tax income is

$$y'_i = y_i(1 - \tau) + \tau \bar{y}$$

for $i \in \{R, P\}$.

- (a) What are payoffs for the rich and the poor?
- (b) Next, assume that a revolution may occur. In the revolution a γ share of society's resources are destroyed. The revolutionaries implement a tax rate $\tau' > \tau$. What are the post-revolution payoffs for the rich and the poor?
- (c) Assume that τ' is fixed to be some number, g , in the second period. That is, in period 2, the revolutionaries always implement $\tau' = g$. Also assume that in period 1, the elites choose τ knowing that τ' will be set to g .
 - (i) What is τ ?
 - (ii) How does the choice of τ vary with g ? Interpret this in words.
 - (iii) How does the choice of τ vary with γ ? Interpret this in words.
- (d) Modify (c) in the following way. Now assume that in period 2, the revolutionaries will optimize and choose τ' . That is, instead of always picking $\tau' = g$, they will choose τ' to optimize their payoff.
 - (i) What happens to τ ? Interpret in words.
 - (ii) How does this change as γ changes? Interpret in words.
 - (iii) Compare your answers in (d) to (c).

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