

1. Review question (50 points) Use a general equilibrium framework to discuss the efficiency and redistributive effects of privatizing the (open-access) commons

- (1) in the absence of transaction costs.
- (2) in the presence of transaction costs.

2. Grazing land as a renewable resource (50 points) The production function for *annual* beef production on a pasture is given by

$$B_t = G_t B(H_t), \text{ with } B_H > 0, B(0) = 0, \lim_{H_t \rightarrow \infty} B(H_t) = 1$$

where B_t , G_t , and H_t respectively denote the beef produced (tons), the amount of grazable grass (tons), and the number of beef cattle (heads) allowed to graze. The amount of grass available in year $t + 1$ depends solely on the number of beef cattle used the preceding year, i.e.

$$G_{t+1} = G(H_t),$$

with $G'(H_t) < 0$, $G(0) = G_0$, $\lim_{H_t \rightarrow \infty} G(H_t) = 0$. Beef sells at a price of p per ton, and the cost of herding, transporting, and processing *each* head of cattle is c .

- (1) Given G_t , *characterize* the conditions for
 - (a) the maximum beef production.
 - (b) the number of cattle that will maximize year t 's profits.
 - (c) The *open access* number of cattle.

Interpret briefly your results. (We assume that the second-order conditions for a maximum are always satisfied.)

- (2) Characterize the conditions for a steady-state equilibrium herd size under open access, year-to-year profit maximization, and maximum sustainable yield.
- (3) Characterize the steady-state equilibrium conditions for a single owner who maximizes the present value of his grazing land, using a discount rate value of r . Interpret your result.