

## ECON4910, Spring 2010

### Seminar 4

Consider a one consumer economy where consumption  $C$  is equal to  $Y - G$ , where  $Y$  is output and  $G$  is an exogenously given level of public expenditure.  $Y = F(L, E)$ , where where  $L$  is labour supply and  $E$  is aggregate emissions of some pollutant. Assume that  $F_{LL} = F_{LE} = 0$  and  $F_{EE} < 0$ .

1. Show that for suitable values of  $w$ ,  $a$  and  $b$  (all positive and  $a + b < 1$ ) these properties follow from output being equal to

$$Y = \max_{\ell} [w\ell + (L - \ell)^a E^b - pE]$$

2. Give an interpretation of this production function.

The consumer's utility function  $u(C, L, E)$  is given by

$$u(C, L, E) = \log C - hL - kE$$

3. How does the willingness to pay for reduced  $E$  depend on  $C$  and  $L$ ?

All non-wage income goes to the government through government ownership or a hundred percent profit tax). The (gross) wage rate in this economy is  $w$ , and the person pays a tax equal to  $twL - s$ , where  $t$  is positive and  $s$  may be positive or negative.

4. How does the labour supply depend on  $t$  and  $s$ ?
5. Derive an expression for the optimal emission tax, and compare it with the Pigovian level for the following three cases:

- $t$  and  $s$  are chosen optimally
- $t$  is exogenously given and  $s$  is chosen so the government's budget is balanced
- $s$  is exogenously given and  $t$  is chosen so the government's budget is balanced

6. Would your answers to question 5 be changed if all profits in the economy went to an owner that did not count in the economy's welfare function (e.g. a foreign owner)?