

# Environmental & Resource Economics

## Toulouse School of Economics, Master 1

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### Exam, Spring 2017, Session 2

#### Question 1 (5p)

Provide three arguments why economic theory favors economic instrument over prescriptive regulation. (In class we listed 4 arguments.) (5p)

#### Question 2 (5p)

You have obtained the table below which contains descriptions of the variables used, descriptive statistics, and the regression results from a hedonic regression analysis.

Table 1: Variable descriptions, descriptive statistics, and estimation results

Variable	Description	Descriptive statistics		Regression results	
		Mean	(Std.dev.)	Coeff.	(Std.err.)
Cost <sup>a</sup>	Annual cost of car ownership	2,500	(1,800)	NA <sup>c</sup>	NA <sup>c</sup>
Constant	Intercept in regression	NA	NA	7.70	(6.11)
Acceleration	Inverse acceleration time from 0 to 100 km/h	0.09	(0.02)	0.78	(0.13)
Cargo	Cargo capacity (m <sup>3</sup> )	0.86	(0.13)	0.54	(0.18)
Comfort	Consumer rating, 0–100	53	(37)	0.27	(0.18)
Fatal <sup>b</sup>	Number of annual fatalities per 100,000 models in use	10	(13)	-0.12	(0.03)
Convertible	Dummy equal to one if convertible	0.17	(0.38)	0.36	(0.12)
$R^2$		0.67			

a: Annualized cost of the price of the vehicle

b: Fatality rate to be interpreted as annual fatality probability

c: Cost is the dependent variable in the regression

The hedonic price regressions used was specified as follows:

$$\ln(C_i) = \beta_0 + \beta_1 \ln(A_i) + \beta_2 \ln(L_i) + \beta_3 \ln(S_i) + \beta_4 \ln(F_i) + \beta_5 \ln(O_i) + \varepsilon_i$$

where  $C$ ,  $A$ ,  $L$ ,  $S$ ,  $F$ , and  $O$  denotes Cost, Acceleration, Cargo, Comfort, Fatal, and Convertible, respectively.

Q2.a: Show the expression for the implicit price, i.e. the individual marginal willingness to pay, for the fatality risk (i.e. the variable Fatal) and estimate its monetary value. (Note: Since Fatal rescaled in regression your calculations should be multiplied by 100000.)

Q2.b: Calculate the elasticity of Cost with respect to Fatal.

### Question 3 (5p)

Consider a firm with single output, which is produced with two inputs, capital  $K$  and energy  $E$ . The cost of production is given by  $TC = eE + rK$ , where  $e$  represents the cost of energy and  $r$  the cost of capital. Assume a single constraint  $y = 10K^{0.5}E^{0.5}$  where  $y$  is total output produced.

Q3a. Write the Lagrangian to this cost minimization problem and derive the necessary First Order Conditions. How will factors be employed?

Q3b. Show graphically the optimal point of production from Q3a. How would the factor deployment change in case the company decides to invest in energy efficiency (there are two possible scenarios).

Q3c. Is the following statement true or false? Provide a brief explanation for your answer.

*A Pigouvian tax does always lead to socially optimal purchase quantity and socially optimal utilization of energy-using goods.*

### Question 4 (5p)

Consider an economy with a representative agent having a constant relative risk aversion  $\gamma = 2$ , and a constant rate of impatience  $\delta = 0\%$ . Let  $c_t$  denote consumption at date  $t$ . Suppose that  $c_t$  follows a geometric Brownian motion with trend  $\mu = 2\%$  and a volatility of  $\sigma = 4\%$ .

1. Compute the term structures of risk-free discount rates and risk premia.
2. Evaluate the NPV of the following three projects: All projects have an initial cost  $\varepsilon$  today.
  - Project A yields a single benefit of  $2\varepsilon$  in 10 years.
  - Project B yields a single benefit of  $10\varepsilon$  in 100 years.
  - Project C yields an uncertain benefit of  $10\varepsilon (c_{10} / c_0)^{-1}$  in 10 years.