**Health Production Function**

1) Define the main mortality and morbility indicators and interprete them.

2) Compute the standarized rate of mortality for Madrid and Castilla y León, using the national population as the standard population and taking into account the information in the following table (the mortality rates are per 1000 people):

| | Mortality rate by sex per 1000 inhabitants (2004) | | Population | |
|---|---|---|---|---|
| | Males | Females | Males | Females |
| Spain | 9.30 | 8.16 | 21,285,247 | 21,912,437 |
| Madrid | 7.32 | 6.68 | 2,804,962 | 2,999,867 |
| Castilla y León | 11.41 | 10.00 | 1,231,258 | 1,262,660 |

Suppose that the mortality rates for people under and over 65 were the same but that the age structures were different:

| | Mortality rate by sex per 1000 inhabitants (not real numbers) | | Population | |
|---|---|---|---|---|
| | Under 65 years | Over 65 years | Under 65 years | Over 65 years |
| Spain | 7.50 | 8.00 | 0.83 | 0.17 |
| Madrid | 7.50 | 8.00 | 0.95 | 0.05 |
| Castilla y León | 7.50 | 8.00 | 0.60 | 0.40 |

3) (Exam September 2011) The OECD (2000) estimated the following premature mortality model by OLS (ordinary least squares) using aggregate data for 21 countries from 1970-1992:

$$\ln H_{it}=\alpha_i + \beta_1 \ln Texp_{it}+ \beta_2 \ln Pubexp_{it}+ \beta_3 \ln GDP_{it}+ \beta_4 \ln Status_{it}+ \beta_5 \ln Polut_{it}+ \beta_6 \ln Alcohol_{it}+ \beta_7 \ln Tobacco_{it}+ \beta_8 \ln Fat_{it}+ \beta_9 \ln Sugar_{it}+ \varepsilon_{it}$$

Where:
i=country,
t=year,
$\alpha_i$ is a vector of dummy variables that captures the constants of each country i
$H_{it}$= Total number of years of life lost between 0-69 years, per 100.000 people for all causes except suicides, for country I in year t
$Texp_{it}$= Total expenditure in health care per person in chained 1990 US dollars and adjusted by the purchase power parity of country i in year t
$Pubexp_{it}$= Public expenditure in health care as a percentage of the total expenditure in health care, for country i in year t
$GDP_{it}$= Gross domestic product in chained 1990 US dollars and adjusted by the purchase power parity of country i in year t
$Status_{it}$ = White-collar worker as a percentage of the total labour force
$Polut_{it}$= Emissions of NOx per person, in Kg

Alcohol $_{it}$= Alcohol consumption, liters per citizen older than 15 years old
Tobacco $_{it}$= Tobacco consumption expenditures per citizen older than 15 years old, measured in chained 1990 US dollars and adjusted by the purchase power parity
Fat $_{it}$= Butter consumption per person, in Kg
Sugar $_{it}$= Sugar consumption per person, in Kg

The results of running this regression are presented in Table 2, where the first column shows the results for females while the second column shows the results for males.

a) Comment on the signs of the estimated coefficients. Do they have the expected sign?
b) Assume that the proportion of white-collar workers (Status) increases in 10%. Compute the percentage reduction in the premature mortality (H) for males and females respectively. Show your calculations. Compute the increase in GDP comparable to this reduction in premature mortality.

Table 2. **Fixed-effect estimates of the determinants of premature mortality in 21 OECD countries, 1970-1992**

| Variable | Women | | Men | |
|---|---|---|---|---|
| | Coefficient | t-statistic | Coefficient | t-statistic |
| *Texp* | –0.1771 | –4.5 | –0.0375 | –1.1 |
| *Pubexp* | –0.1663 | –2.6 | –0.1774 | –3.2 |
| *GDP* | –0.3499 | –5.3 | –0.4395 | –7.7 |
| *Status* | –0.8098 | –10.2 | –0.7441 | –10.7 |
| *Polut* | 0.0496 | 2.0 | 0.0949 | 4.4 |
| *Alcohol* | 0.2049 | 6.4 | 0.1621 | 5.8 |
| *Tobacco* | 0.0916 | 3.2 | 0.1790 | 7.1 |
| *Sugar* | 0.1220 | 3.5 | 0.1096 | 3.6 |
| *Fat* | 0.0148 | 0.9 | 0.0445 | 3.1 |
| Australia | 0.0181 | 0.3 | –0.0223 | –0.4 |
| Austria | 0.0319 | 0.5 | 0.1067 | 1.9 |
| Belgium | 0.1521 | 2.3 | 0.1531 | 2.6 |
| Canada | 0.1921 | 2.8 | 0.1221 | 2.0 |
| Denmark | –0.0070 | –0.1 | –0.0821 | –1.2 |
| Finland | –0.1504 | –2.0 | 0.0971 | 1.5 |
| France | –0.0071 | –0.1 | 0.1725 | 2.4 |
| Germany | 0.0936 | 1.3 | 0.0909 | 1.4 |
| Greece | –0.3481 | –7.1 | –0.2772 | –6.4 |
| Ireland | –0.1840 | –2.8 | –0.2633 | –4.6 |
| Italy | –0.0570 | –1.1 | 0.0447 | 1.0 |
| Netherlands | 0.0018 | 0.0 | –0.0453 | –0.9 |
| New Zealand | 0.1579 | 2.1 | 0.0688 | 1.1 |
| Norway | 0.0917 | 1.3 | 0.1581 | 2.6 |
| Portugal | –0.3326 | –7.0 | –0.0511 | –1.2 |
| Spain | –0.5083 | –11.0 | –0.2255 | –5.6 |
| Sweden | 0.0938 | 1.4 | 0.0207 | 0.4 |
| Switzerland | –0.0379 | –0.5 | 0.0839 | 1.2 |
| United Kingdom | 0.2066 | 3.3 | 0.0815 | 1.5 |
| United States | 0.4151 | 5.5 | 0.3591 | 5.4 |
| Intercept | 8.1596 | 15.8 | 7.8469 | 17.3 |
| $R^2$ | 0.94 | | 0.95 | |
| F | 252 | | 292 | |
| DW | 2.08 | | 2.20 | |

*Sample:* 21 countries, 1970-1992, 483 observations. See Table 1 for the definitions of the variables.

Short Questions

1. (Exam Sep. 2003) Assume that the following regression has been constructed with data for OECD countries. The subindex i indicates the country, the variable $S_i$ indicates life expectancy at birth in country i, $G_i$ indicates the per capita health expenditures in country i and $F_i$ the per capita expenditures onmedicines for country i. $u_i$ is the error term.

$$S_i = c_0 + \alpha G_i + \beta F_i + u_i$$

The results are:

$$\hat{\alpha} = 0,01$$

$$\hat{\beta} = 0,02$$

And asume the values for Spain are:

$$S_{España} = 90$$

$$G_{España} = 180$$

$$F_{España} = 45$$

Which of the following is true?

a) For Spain, the elasticity of life expectancy with respect to $G$ is 0.01 and 0.02 with respect to F.

b) The effect of 10 additional euros per capita on G is 0.1 years old and on F is 0.2 years old, but the elasticity of life expectancy relative to G is less than with respect to F for Spanish data.

c) The effect of 10 additional euros per capita on G is 0.1 years old and on F is 0.2 years old, but the elasticity of life expectancy relative to G is greater than with respect to F for Spanish data.

d) The effect of 10 additional euros per capita on G is 0.1 years old and on F is 0.2 years old, but the elasticity of life expectancy relative to G is the same with respect to F for Spanish data.