PROBLEM SET 5
Due on Friday, Apr 29.

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Instructions:

- Make sure you are working on your problem set as each problem set is different.
- **The answers to the questions of this problem set are to be given exclusively in the answer sheet**
- **The answers sheet MUST be printed and not photocopied. Photocopies will not be accepted.**
- Questions marked with the symbol ♣ admit more than one correct answer
- Please fill the boxes in the answer sheet completely using a **black pen** as follows

Question 1: ■ B C D E

- The answer sheet must not be creased or folded otherwise your problem set won't be graded.
- **You can hand back your problem set at the END of class on Friday, April 29th.**

With a sample of 706 observations, we estimate the following model:

$$ln(hwage_i) = \beta_0 + \beta_1 age_i + \beta_2 age_i^2 + \beta_3 educ_i + \beta_4 yngkid_i + u_i$$

and obtain these results:

$$ln(hwage_i) = -\underset{0.41175}{1.00179} + \underset{0.01941}{0.07121} age_i - \underset{0.00024}{0.00076} age_i^2 + \underset{0.01116}{0.07131} educ_i + \underset{0.07006}{0.09439} yngkid_i$$

where *lhwage* is the logarithm of the hourly wage in euro, *age* is measured in years, *educ* is years of education and *yngkid* is a variable equal to 1 in case the person has a child younger than three years.

Question 1 What is the interpretation of β_1?

- A By itself does not have a proper interpretation.
- B Increasing age by one year, the hourly wage increases by 7.1% on average, ceteris paribus.
- C Increasing age by one year and keeping its square fixed, the hourly wage increases by 7.1% on average, ceteris paribus.
- D Increasing age by one year, the hourly wage increases by 0.071 euros on average, ceteris paribus.

Question 2 What is the interpretation of β_4?

- A If a person has small kids ($<$ 3 years old), he/she earns about 0.095 euros more per hour with respect to someone who does not have small kids, ceteris paribus.
- B If a person has small kids ($<$ 3 years old), he/she earns about 9.5% more per hour with respect to someone who does not have small kids, ceteris paribus.
- C If a person has one small kid more, he/she earns about 0.095 more per hour with respect to someone who does not have small kids, ceteris paribus.
- D If a person has one small kid more, he/she earns about 9.5% more per hour with respect to someone who does not have small kids, ceteris paribus.

Question 3 What is our null hypothesis when we test whether β_1 and β_2 are jointly significant?

- A We check whether the logarithm of hourly wage is 0 when age is equal to 0.
- B We check whether the logarithm of hourly wage depends on age.
- C We check whether the relationship between the logarithm of hourly wage and age is convex or concave.
- D We check whether the logarithm of hourly wage depends linearly on age.

Question 4 Is β_1 statistically significant?

- A It is not at 5% level.
- B We cannot check for this, it makes no sense.
- C It is at 10% level.
- D It is not at 1% level

Question 5 Keeping other variables fixed, at what age the logarithm of hourly wage is maximized?

- A At about 0, but this makes no sense.
- B At about 56.3 years.
- C At about 46.7 years.
- D At about 93.3 years.

Question 6 Using a subset of the variables in the previous model, we would like to write a new one such that we obtain the elasticity of the hourly wage to education, and that, given in increase of one year in age, it returns a change in hourly wage in percent points. Choose the correct model among these:

- A $hwage_i = \beta_0 + \beta_1 ln(age_i) + \beta_2 educ_i + u_i$
- B $ln(hwage_i) = \beta_0 + \beta_1 ln(age_i) + \beta_2 educ_i + u_i$
- C $ln(hwage_i) = \beta_0 + \beta_1 age + ln(\beta_2 educ_i) + u_i$
- D $ln(hwage_i) = \beta_0 + \beta_1 age_i + \beta_2 ln(educ_i) + u_i$
- E $hwage_i = \beta_0 + \beta_1 age_i + \beta_2 ln(educ_i) + u_i$

Let us define with Y the amount of cholesterol in mlg in the blood and with Med a dummy variable which takes the value of 1 for medication B and 0 for medication A, where A and B are two different medications that lower cholesterol. Female is a dummy variable which takes the value of 1 for females and 0 otherwise.

Consider the following regression:

$$Y = \beta_0 + \beta_1 \times med + \beta_2 \times female + \beta_3 \times med \times female + u$$

Question 7 What is the average cholesterol value for men when using medication B?

- A β_0
- B None of the others.
- C $\beta_1 + \beta_3$
- D $\beta_0 + \beta_1$
- E β_3
- F β_1

Question 8 Suppose you use this model: $Y = \beta_0 + \beta_1 \times med + \beta_2 \times female + u$ What would be the underlying assumption in this case?

- A None of the others.
- B There are no gender differences in the average cholesterol level.
- C Medication A and B may operate differently between females and males.
- D Males and females choose to take the same medication (either A or B).
- E Medication A and B do not operate differently between females and males.

These data are taken from the Medical Expenditure Panel Survey survey conducted in 1996. These data were provided by Professor Harvey Rosen of Princeton University and were used in his paper with Craig Perry "The Self-Employed Are Less Likely Than Wage-Earners to Have Health Insurance. So What?" in Douglas Holtz-Eakin and Harvey S. Rosen, eds., Entrepeneurship and Public Po licy, MIT Press 2004.

Among the variables in the dataset, `ins` is a dummy equal to one if the interviewee has the insurance; `selfemp` is equal to one if the interviewee is a self-employed workers; `gender` is equal to one if the in dividual is a male; `married` is one if the individual is married; `health` is one if the individual reports to be in good health; `educ` is 0 if the person has no education, 1 if he/she achieved middle school diploma, 2 for the high school diploma, 3 for the bachelor degree, 4 for the master degree and 5 for the PhD; `age` is in years and `age2` is the square of age.

We estimate two models:

$$\begin{aligned} Pr(ins = 1|X) &= \beta_0 + \beta_1 \times selfemp + \beta_2 \times married + \beta_3 \times gender + \beta_4 \times health \\ &\quad + \beta_5 \times gender * health + \beta_6 \times educ + \beta_7 \times age + \beta_8 \times age^2 \end{aligned}$$

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Coefficients:
               Estimate Std. Error t value  Pr(>|t|)
(Intercept)    0.2974634  0.0580248    5.13 0.0000003
selfemp       -0.1742361  0.0141740  -12.29   < 2e-16
married        0.1181062  0.0094187   12.54   < 2e-16
gender        -0.0232270  0.0343575   -0.68   0.49903
health         0.0744310  0.0247243    3.01   0.00262
genderxhealth -0.0206248  0.0353131   -0.58   0.55920
educ           0.0529807  0.0029210   18.14   < 2e-16
age            0.0105315  0.0027482    3.83   0.00013
age2          -0.0000788  0.0000333   -2.37   0.01796
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Heteroskadasticity robust standard errors used
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$$\begin{aligned} Pr(ins = 1|X) = \Phi(&\beta_0 + \beta_1 \times selfemp + \beta_2 \times married + \beta_3 \times gender + \beta_4 \times health \\ &+ \beta_5 \times gender * health + \beta_6 \times educ + \beta_7 \times age + \beta_8 \times age^2) \quad \text{(II)} \end{aligned}$$

```
Coefficients:
               Estimate Std. Error z value Pr(>|z|)
(Intercept)    -0.844932   0.195991   -4.31 0.000016
selfemp        -0.651923   0.046842  -13.92  < 2e-16
married         0.455241   0.034845   13.06  < 2e-16
gender         -0.040238   0.111653   -0.36  0.71856
health          0.300503   0.082988    3.62  0.00029
genderxhealth  -0.124880   0.116613   -1.07  0.28422
education       0.226139   0.012852   17.60  < 2e-16
age             0.029150   0.009899    2.94  0.00323
age2           -0.000162   0.000126   -1.29  0.19821
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Question 9 What is the intepretation of β_6 in model (II)?

- [A] It does not have a proper interpretation in terms of magnitude.
- [B] Increasing years of education by one, makes the individual 22.6% ore likely to have an insurance, holding all other things constant.
- [C] Increasing years of education by one, on average, makes the individual 22.6% more likely to have an insurance, *ceteris paribus.*
- [D] Increasing a person's education level by one, on average, makes he/she 22.6% more likely to have an insurance, *ceteris paribus.*

Question 10 How do you interpret the intercept under model (I)?

- [A] It is the probability to have an insurance for a female, not self employed, non-married, with a bad health status, no education and with age equal to 0.
- [B] It is the probability to have an insurance for a male, not self employed, non-married, with a bad health status, no education and with age equal to 0.
- [C] It does not have a real meaning in this case.
- [D] It is the average probability of having an insurance in our sample.

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- Please fill the boxes below completely using a **black pen**.
- Do not crease or fold.
- You can hand back your problem set by putting it into my mailbox on the fifth floor of the viale Romania campus by noon of Friday, March 25 at noon.

Question 1: ☐A ☐B ☐C ☐D
Question 2: ☐A ☐B ☐C ☐D
Question 3: ☐A ☐B ☐C ☐D
Question 4: ☐A ☐B ☐C ☐D
Question 5: ☐A ☐B ☐C ☐D
Question 6: ☐A ☐B ☐C ☐D ☐E
Question 7: ☐A ☐B ☐C ☐D ☐E ☐F
Question 8: ☐A ☐B ☐C ☐D ☐E
Question 9: ☐A ☐B ☐C ☐D
Question 10: ☐A ☐B ☐C ☐D