

Written Re-exam for the B.Sc. in Economics
August 2011

Econometrics A

2. year

August 22th 2011

(3-hour open book exam, calculators are not
allowed)

Please note that the language used in your exam paper must correspond to the language of the title for which you registered during exam registration. I.e. if you registered for the English title of the course, you must write your exam paper in English. Likewise, if you registered for the Danish title of the course or if you registered for the English title which was followed by “eksamen på dansk” in brackets, you must write your exam paper in Danish.

If you are in doubt about which title you registered for, please see the print of your exam registration from the students’ self-service system.

Question 1

Households consumption of electricity during a day is given by X , which is a normal distributed random variable with mean 12 kWh and variance 4 kWh². As an experiment, which has electricity savings potential, the supplier of electricity randomly installs electronic meters in 1000 households. The meter is capable of giving the household feedback on their electricity consumption by sending a SMS if consumption in a given week deviates with 25 percent from the mean of the last four weeks of electricity consumption.

1. What is the probability that a household receives a SMS during a week?
2. Assuming that households do not change behaviour, what is the probability of receiving at least one SMS during eight weeks?

The firm is interested in knowing whether the feedback reduces electricity consumption. The firm samples randomly 100 households with feedback (labeled treatments) and randomly 100 household without feedback (labeled controls). The electricity consumption of treatments is independent and identically normal distributed with mean consumption of electricity of 11.8 kWh and variance 4. The electricity consumption of controls is independent and identically normal distributed with mean consumption of electricity of 12 kWh and variance 4.

3. What is the probability that a randomly chosen treatment has lower consumption than a randomly chosen control? What is the probability that the average consumption of the 100 treatments is lower than the average consumption of the 100 controls? Why do the probabilities differ?

Question 2

A firm considers offshoring some of its production to three different low-wage countries. However, the low wage-countries are political unstable. The firm fears that changes in the political system can cause the government to nationalize all production, which means the death of the offshored activities. A young economist has been employed in the firm in the office for political economy to research the political system in the countries (labeled A, B and C), and she found out that in any year the conditional probability of attempting nationalization ($N = 1$) given country is:

	Country A	Country B	Country C
$N = 1$	0.2	0.1	0.05
$N = 0$	0.8	0.9	0.95

If the firm hires a government employee in the beginning of the year, then an attempt of nationalization can be avoided, and the firm will survive. The

conditional probability of avoiding nationalization ($D = 1$) given country and attempted nationalization ($N = 1$) is:

	Country A	Country B	Country C
$D = 1$	0.7	0.5	0.4
$D = 0$	0.3	0.5	0.6

The firm is nationalized with certainty in case of attempt of nationalization and no government employee is hired. The government employee has no effect if the country is stable ($N = 0$).

1. What is the probability that offshored activities survive in country A, B and C in a given year? What is the probability of survival given that the firm randomly chooses a destination country to offshore to?

The problem is that the young economist worked all night and she spilled coffee on her notes, which has removed the identification of countries. Therefore the firm has no strong prior information about the real identity of the three countries. It assigns prior probability $\frac{1}{3}$ to each country. The firm decides to move production abroad to one of the countries and does it randomly.

2. What is the probability that the firm moved production to country A given that the firm moved production and avoided an attempt of nationalization ($N = 1$ and $D = 1$)?

Despite the attempt of nationalization and success in avoiding it in the first year, the firm decides to stay another year in the country. In the second year the firm does not experience an attempt of nationalization ($N = 0$).

3. What is the probability that the firm moved production to country A now? Discuss your result.

Question 3

In the latest PISA survey from 2009 participated 5924 students from Denmark. All students who take the test were given a PISA-score. The following table shows average, standard deviation, minimum and maximum for boys and girls. (PISA = Programme International Students Assessments)

Assume that the PISA-score can be described by a normal distribution for boys (index = 1) and girls (index = 2).

$$N(\mu_1, \sigma_1^2) \text{ and } N(\mu_2, \sigma_2^2)$$

PISA 2009					
Denmark	Numbers	Average	Standard deviation	Minimum	Maximum
boys	2886	480.4	260.7	178.6	716.3
girls	3038	509.2	248.1	211.5	734.1

The average for all countries is 500.

1. Calculate a 95% confidence interval for the boys mean (μ_1).
2. Test if the girls mean is more than 500 ($\mu_2 > 500$).
3. Test if the boys mean is equal the girls mean ($\mu_1 = \mu_2$)

The students have been asked which language they speak at home. The language spoken at home can be either Danish or other language. 1070 students answered that they spoke another language at home. The rest have answered Danish.

Let X be the number of students, who speak another language at home .

4. Explain, why X can be described with a binomial distribution.
5. Let p be the probability that a student speaks another language at home. Calculate an estimate for p . Explain, which properties the estimator has.

In the following table the 5924 students have been classified after gender and which language they speak at home.

	boys	girls	total
Danish	2381	2464	4845
Other	505	574	1079
total	2886	3038	5924

6. Test if gender is independent from language spoken at home.