

## Worksheet 1

### Economic Data and Econometric Modeling

The following worksheet shows examples concerning the identification of the causal effect.

1. The role of class size (number of students per class) on education performance is a controversial subject, since reducing class size is very expensive. In this sense, a policy of reducing class sizes would be justified only if it meant a substantial improvement in student academic performance.
  - a) The first empirical studies aimed at measuring the impact of class size were based on non experimental data, comparing the grades in comprehensive tests achieved by students from different schools and different class sizes. If we aimed at measuring the relationship between class size and academic performance with such data, could we infer that size has a causal effect on performance? Justify.
  - b) The State of Tennessee (US) implemented an ambitious pilot program in public elementary school, known as STAR program (Student Teacher Achievement Ratio). In this program, over 7,000 students from 79 public primary schools were randomly assigned to 2 class sizes: small (between 13 and 17 students per teacher) and standard (between 22 and 25 pupils per teacher). Teachers were assigned to classes, also at random. The experiment began with the class of 1985-1986, and applied continuously for a period of 4 years (from kindergarten to the third elementary grade). How does your answer to the question above changes if we use data from this experiment? Justify.
2. (Based on Angrist and Pischke, “Mostly Harmless Econometrics”. Princeton U. Press, 2009, Chapter 2)

A substantial proportion of elderly population uses hospital emergency rooms, while they could be properly attended through primary care service. Some of these patients are admitted to the hospital. This care type is expensive, and crowds hospital facilities. Besides, exposure to other sick patients by those who are themselves vulnerable might affect their health negatively.

The US National Health Interview Survey (NHIS) from 2005 provides information, for the last 12 months, about the patient health status (from 5 -excellent- to 1 -poor-), as well as if the respondent has been patient in a hospital overnight. The results are as follows:

GROUP	N	Health status	
		Meand	Std. dev.
Hospitalized	7774	3,21	0,014
Non hospitalized	90049	3,93	0,003
Mean difference = -0,72			
<i>t</i> statistic = 58,9			

- a) Are there significant differences in health status of those who were hospitalized and those who were not? Should we conclude that hospital treatment makes people sicker?

- b) Are the group of those who were hospitalized and the group of those who were not comparable? Explain.
- c) Is the comparison between two groups appropriate to evaluate causal effect on health of receiving hospital treatment?
- d) If you could implement an ideal experiment to evaluate such causal effect, how it should be?
3. The presence of more policemen to fight crime is a matter of controversy. Suppose that we have data, for all the province capital cities in Spain, about crime incidence per 10000 inhabitants and number of police units per 10000 inhabitants. With such data, ¿could we obtain the causal effect of police surveillance on crime incidence? If not, propose an appropriate experiment to assess such causal effect.
4. We want to ascertain whether increasing the number of children's books within a home has a causal effect on academic performance of the children at that home.
- a) Suppose there is a positive correlation between the amount of children's books within a home and the academic performance of the children at that home. State whether each of the following assertions is true, justifying your answer:
- I. We can infer that the higher the number of children's books at home, the better the academic performance of the children at that home.
  - II. The fact that there are many children's books at home can be reflecting other factors, like parents' intelligence.
  - III. The number of children's books at home has a positive causal effect on the academic performance of children at such home.
- b) Suppose we address an experiment among families whose children attend a certain school in the same academic degree, for which we consider three alternative designs:
- I. We randomly allocate, among such families, different amounts of children's books.
  - II. We randomly allocate, among the families whose parents are illiterate, different amounts of children's books.
  - III. We leave batches of children's books available to all those families that want to pick them.
- Indicate what design(s) allow to infer a causal effect, justifying your answer.
5. We want to ascertain whether class size has a causal effect on academic performance within the class, for which we analyze children in their sixth elementary grade.
- a) Suppose that, considering all the groups in their sixth elementary grade in Madrid, we find a negative correlation between class size and academic performance. State whether each of the following assertions is true, justifying your answer:
- I. We can infer that the smaller the class size, the better the academic performance of children.
  - II. The fact that certain children are in classes of smaller size can be reflecting other factors, like family income, parents' education, or school quality.
  - III. Class size has a positive causal effect on academic performance of children.

b) Suppose we address an experiment among sixth grade students in Madrid, for which we consider three alternative designs:

I. We randomly allocate children with worse previous performance to classes of smaller size.

II. We randomly allocate all children to classes of different sizes.

III. We allocate children, at parents' request, to classes of smaller size.

Assuming that all children continue all the academic year in their allocated class, indicate what design(s) allow to infer a causal effect, justifying your answer.