

## Natural Experiments

### I. Background

Why do economists like them?

- Natural experiments are plentiful and inexpensive (for researchers, at least).
- They often provide convincing control and treatment groups.
- They provide real-world evidence (in contrast to randomized trials, where we may have to worry about cream-skimming and micro vs. macro effects).

Sources of concern:

- Potential for legislative endogeneity

Ex. A state has a bad economic shock, so legislators increase UI benefits at the same time that unemployment durations are increasing. The naïve investigator decides that higher UI benefits lead to longer unemployment durations.

- Potential for compositional biases

Ex. A worker only claims worker's compensation if the expected benefits (duration\*daily benefits) are greater than the expected hassle costs of 120. Conditional on claiming benefits, his duration= $\alpha + .5$ \*daily benefits, where  $\alpha$  is the underlying (non-moral hazard) duration. Suppose that there are 20 injured workers, with underlying durations ranging from 1 to 20 days. (Person 1 has underlying duration of 1, person 2 has underlying duration of 2, etc.) If initial daily benefits are 7, then we will find that only 3 people take up (persons 18, 19 and 20) and the mean duration is 22.5 days. If we increase the benefits to 10, we will find that 9 people take up (persons 12 through 20) and the mean duration will fall to 20 days. The 2.5-day decrease in duration confuses two separate issues: a) the increase in moral hazard, with the initial 3 recipients increasing their mean duration from 22.5 to 24, and b) the composition change, with 6 new recipients who have shorter underlying durations, deciding to take up.

- Possibility that control groups and treatment group have differential trends over time.  
Do we really have a good control group??

Ex. A state increases the minimum wage. We find that, after the policy, employment among minimum wage employees decreases relative to employment among non-minimum-wage workers. But you could imagine that, due to skill-biased

technological change, the demand for low-skill workers (who are paid the minimum wage) may be increasing at a different rate than demand for high-skill workers (who aren't paid the minimum wage). So we can't necessarily conclude that the minimum wage has *caused* the differential change in employment.

## **II. Application:** Alan Krueger's work on Workers' Compensation and the duration of workplace injuries

We want to determine how WC benefits affect the duration of workplace injuries.

### Ideal Set-up:

We would look at the same person with the same injury and determine how their injury duration changes when we give them different levels of benefits. But we can't do this.

### Previous work:

Typically found positive relationship between benefits and durations, with elasticities around 0.4. But they didn't use a natural experiment set-up. Instead, they ran regressions of duration on benefits and wages, assuming that the variation in benefits between different workers is exogenous. However, benefits are a function of wages, so it becomes impossible to disentangle the effects of wages, benefits, and motivation (which may be correlated with wages). Hence, the results are difficult to interpret and unconvincing.

### Krueger's natural experiment:

The state of Minnesota changed their benefit schedule on October 1, 1986, but only for certain workers (workers on segments A,C & E, but not B & D). As a result, identical workers on segments A,C & E receive different benefits, depending on whether they were injured before or after October 1<sup>st</sup>. Workers on segments B & D receive the same benefits, regardless of when they were injured. This "natural experiment" allows Krueger to compare the duration of work injuries for worker in the same state who earned the same wages, but received different benefits! This technique is referred to as a difference-in-difference (DD) specification.

The set-up:

General DD set-up:

	After	Before	Difference
<b>Treatment</b>	$D^T_A$	$D^T_B$	$D^T_A - D^T_B$
<b>Control</b>	$D^C_A$	$D^C_B$	$D^C_A - D^C_B$
	$D^T_A - D^C_A$	$D^T_B - D^C_B$	$(D^T_A - D^T_B) - (D^C_A - D^C_B)$

As an example, compare durations (in log weeks) on Segment A to durations on Segment B, before and after the policy change:

	After	Before	Difference
<b>Treatment</b>	.958	.723	.235
<b>Control</b>	.815	.801	.014

Effect on durations =  $(D^T_A - D^T_B) - (D^C_A - D^C_B) = .235 - .014 = .221$   
 Implied elasticity = 3.68

Elasticity:

The elasticity is calculated as follows. Note that :

1. the duration and benefit variables are in logs
2. the difference of a variable in logs approximates the percent change in the variable

Here the A and B refer to segments A and B (not before and after as above). D denotes duration and L denotes the benefit.

$$0^{AB} = (D^A - D^B) / (L^A - L^B) = (.235 - .014) / (.055 - (-.005)) = .221 / .06 = 3.68$$

Krueger makes similar calculations, comparing all of the segments and comes to the conclusion that the elasticity is probably around 2.0

Potential Problems:

- Legislative Endogeneity?  
 He gets around this issue by the set-up of his experiment. It's hard to believe that the legislation was constructed in response to increased injuries among people in segments A, C & E.
- Composition of Injuries?
  - 1) More generous benefits encourage some workers with minor injuries to pursue claims that they otherwise wouldn't have.
  - 2) Higher benefits may induce some workers to take more risks on the job, resulting in more serious injuries

Krueger's analysis of these issues:

- a) Look for compositional changes in the data. He finds that the relative frequency of injuries involving bone fractures increases by about 3% after policy shift. No differences in cases of sprains, back injuries, multiple injuries, etc.
- b) Control for other characteristics, such as demographics, type of job, work schedule, etc. These controls slightly reduce the estimated elasticity.  
→ Suggestive that compositional changes are small.

- Differential trends for Control and Treatment Groups?  
Again, he gets around this issue by the set-up of his experiment. You might believe that people on segment A have differential injury duration trends than people on segment B, but it's hard to believe that people on segments A, C & E have been trending together in a manner that is different from people on segments B & D.