

Tax Facts

A knowledge-based series by the
Tax and Transfer Policy Institute

Economic Fundamentals: Randomised Control Trials and Natural Experiments

Randomised control trials (RCTs)

RCTs are viewed as the 'gold standard' of evidence because they allow the impact of a policy to be measured in isolation from other factors that might influence the results. In an RCT, individuals are randomly assigned to either a treatment or a control group. For example, among a group of unemployed workers, some workers (the treatment group) would receive employment coaching, while the remaining workers (the control group) would not.

The random assignment of individuals to the control and treatment groups implies that individuals in both groups should not differ in any systematic way, other than their treatment status. Any differences between the two groups following the treatment are likely to be a result of the treatment. Using the preceding case, any differences in employment rates between the control and treatment groups should be due to the coaching.

Entities other than individuals can also be examined using RCTs. For instance, an RCT might examine the effect of a certain treatment on firms. For simplicity, this tax fact will only refer to RCTs involving individuals.

Natural experiments

A natural experiment tries to approximate an RCT by finding situations where individuals have been unintentionally assigned to treatment and control groups that are 'as-good-as' a deliberate random assignment. Natural experiments are sometimes called 'quasi-experiments'.

Natural experiments can include:

- *Deliberately randomised processes* that were randomised for non-experimental reasons. For example, Australia used a lottery that randomised conscription using birth dates during the Vietnam War.
- Policies that varied based on a characteristic that *individuals could not control* and that did not make them substantially different to each other – such as a policy only affecting individuals on one side of birth date cut-off.
- Cases where a policy varied based on a characteristic that *individuals could not control precisely* – for instance, looking at those who fell just below or above a test threshold to qualify for a selective school or a health treatment.

What is required for a natural experiment?

The key requirement of a natural experiment is the 'as-good-as' random allocation of individuals to treatment and control groups. A before and after comparison of the same individuals is not a natural experiment. It does not include a control group and does not identify if the treatment produced results different to those that would have been observed without the treatment. It is sometimes possible to find natural experiments using data from before and after a policy was introduced, but simply comparing outcomes from before and after is not enough.

The allocation of individuals to treatment and control groups does not need to be perfect. In the Vietnam draft lottery, some people who were not drafted served regardless, and some people who were drafted did not serve. To be a natural experiment, the random allocation only needs to generate some difference in the status of those assigned to the treatment and the control.

What makes a good natural experiment?

A good natural experiment will have:

- a research question that is *worth learning more about*, meaning that the results will provide useful information about relevant individuals and/or the results may be generalisable to other situations.
- a good *method for approximating an RCT* using available data.
- a *reasonable chance of detecting effects (if they are present) and a low chance of false positives*. This requires a sufficiently large sample, a treatment and/or anticipated effect such that you would expect to detect the effect in the data. It also requires careful use of statistics.

When choosing between research projects, there is often a trade-off between these traits. For instance, it may be difficult to find suitable data for a natural experiment that would investigate the most interesting research questions, or there may be data available that closely approximate an RCT, but have small samples and minor treatments that reduce the chance of detecting effects.

Questions to ask when designing an experiment

Adapted from the prologue in Mostly Harmless Econometrics: An Empiricist's Companion, by Joshua Angrist and Jorn-Steffen Pischke.

- What is the causal relationship of interest?
- What would be the ideal way to test this relationship?
- Are there data that arose from circumstances similar to the ideal test?
- Has the criterion of 'as-good-as' random allocation to treatment and control groups been met and what assumptions need to be made for the experiment to meet this criterion? How could these assumptions fail and how could that be tested for?
- What method will be used to approximate an RCT using the natural experiment?
- Will any conclusions drawn from the results be statistically valid?

There is a large literature using natural experiments, which can provide useful guidance on these assumptions, tests and methods once a candidate has been identified.

An Australian case

Australia's Mature Age Worker Tax Offset (MAWTO) is an example of a natural experiment. The MAWTO was a tax incentive of up to \$500 provided to individuals aged 55 and older who earned income from working. It was designed to encourage older individuals to stay in the workforce. Because individuals aged 55 were eligible for the MAWTO, but individuals aged 54 were not, the Tax and Transfer Policy Institute was able to conduct a natural experiment to examine the policy's effects on workforce participation and earnings after it was introduced in 2004 and after it was repealed in 2014 [see our [working paper](#)].

A quote to keep in mind when designing experiments

'The two hardest things about empirical work are picking projects and knowing when to bail out on projects that are not developing well.' Joshua Angrist.



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