SASCHA O. BECKER
University of Warwick, UK, and IZA, Germany

I Z A
World of Labor
Evidence-based policy making

Using instrumental variables to establish causality

Even with observational data, causality can be recovered with the help of instrumental variables estimation

ELEVATOR PITCH

Randomized control trials are often considered the gold standard to establish causality. However, in many policy-relevant situations, these trials are not possible. Instrumental variables affect the outcome only via a specific treatment; as such, they allow for the estimation of a causal effect. However, finding valid instruments is difficult. Moreover, instrumental variables estimates recover a causal effect only for a specific part of the population. While those limitations are important, the objective of establishing causality remains; and instrumental variables are an important econometric tool to achieve this objective.

Schematic depiction of IV estimation – Effect of education on wages

Note: A UK reform that increased minimum school leaving age is used as the Instrumental variable (IV); it should affect the outcome only via its effect on the endogenous variable but not in other ways. Numbers are based on [1].

Source: Author's own.

KEY FINDINGS

Pros

⊕ Valid instrumental variables help to establish causality, even when using observational data.

⊕ Using instrumental variables helps to address omitted variable bias.

⊕ Instrumental variables can be used to address simultaneity bias.

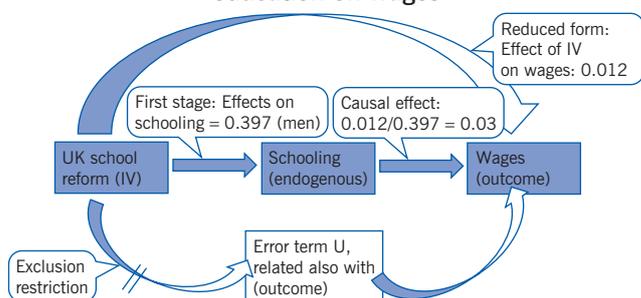⊕ To address measurement error in the treatment variable, instrumental variables can be used.

Cons

⊖ Finding strong and valid instrumental variables that affect participation in the treatment but do not have a direct effect on the outcome of interest is difficult.

⊖ Estimated treatment effects do not generally apply to the whole population, nor even to all the treated observations.

⊖ Estimated treatment effects may vary across different instruments.

⊖ For small sample sizes, and in case of "weak" instruments, instrumental variable estimates are biased.

AUTHOR'S MAIN MESSAGE

When treatment is not randomly assigned to participants, the causal effect of the treatment cannot be recovered from simple regression methods. Instrumental variables estimation—a standard econometric tool—can be used to recover the causal effect of the treatment on the outcome. This estimate can be interpreted as a causal effect only for the part of the population whose participation in the treatment was affected by the instrument. Finding a valid instrument that satisfies the two conditions of (i) affecting participation to the treatment, and (ii) not having a direct effect on the outcome, is however far from trivial.