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PS1: Structural and Reduced Form Estimations

Structural estimation and reduced form estimation (henceforth, SE and RFE) are two major approaches to econometrics that are often considered incompatible with one another. The former emphasizes the significance of economic theories in identifying key parameters for constructing any economic model. Advocates of the latter accuses the former of its dependence on theories that leads to *a priori* assumptions; instead, RFE prefers a “simple” model with instrumental variables “derived from” data. In response, scholars who favor SE argue that the RFE approach is in fact not as innocent of assumptions as it appears. In the following paragraphs, I will take a closer look at each approach, and argue that both approaches are valuable and can be used in complementary manners.

SE in the context of econometrics refers to an approach to modeling based on existing theories. Established theories on the subject matter inform how researchers construct useful models by providing *a priori* assumptions pertinent to the data at hand. To use an example by Keane (2010), to build a model to explain the cognitive ability of a child, the SE approach first consults with the existing literature to identify key variables and how they relate to the cognitive ability of a child, as well as to one another. Informed by the literature, the SE approach will, for example, assume that a child’s ability endowment can be measured indirectly by his or her mother’s level of education. Because SE clearly lays out the mathematical relationships between variables based on its theoretical assumptions, the result of its model is highly interpretable.

On the other hand, RFE seeks for an instrumental variable (IV) that fully explains the behavior of the dependent variable in a succinct fashion. An IV is often an event that “naturally” occurs, which may be an unexpected natural disaster or an administrative/legislative intervention, and creates an experiment-like situation. In this “natural experiment,” subjects are randomly assigned into two groups based on the application of the IV. Accordingly, RFE is also known as an experimental approach. Based on this randomness, RFE argues that the resulting mean difference between the two groups can be attributed to the IV, which is identified based on data rather than any theoretical assumptions. As such, RFE claims to construct models that are less subject to assumptions that may be biased and unrealistic.

However, both Keane (2010) and Rust (2010) correctly point out RFE’s claim to the lack of assumption is unfounded. Take, for example, Angrist’s (1990) draft lottery paper. Although Angrist argues that the use of lottery generates the effect of random assignment and therefore the “treatment” and “control” groups differ only in their draft, i.e. the atheoretic IV, Keane suggests that this explanation is based on implicit statistical assumptions such as the exogeneity of the IV and the homogeneity of the treatment effect, which are no less significant than theoretical assumptions in SE. Furthermore, the RFE approach often fails to explain the mechanism by which its selected IV generates its perceived effect. That is, Angrist’s conclusion that the military service led to, on average, a 15% decrease in income of the veterans falls short in explaining by what means the military service produce such an effect. This is where researchers can benefit from SE’s theoretical consideration on the relationship among variables.

This is not to say that researchers should do away with RFE altogether. RFE’s data-oriented method offers a great solution especially at times when little prior research has been conducted or no generally accepted theory exists with respect to the subject matter. In such cases, a researcher can begin her investigation from finding an IV and then make efforts to explain what the IV may consist of as well as to test the statistical assumptions on which the IV is based. In addition, I believe that RFE provides researchers with novel ways to test the strength of existing theoretical models. Can one explain the effect of an IV using the structural approach? Trying to answer this question will allow researchers to evaluate the validity of the tested SE models and their theoretical assumptions. Nonetheless, it is my opinion that researchers must always proceed to establishing a theoretical understanding that allows for a clear interpretation of the variables and their relationships. Even when a seemingly perfect “natural experiment” is available, researchers must seek to examine the statistical assumptions openly and explicitly, and devise theoretical explanations for the validity or invalidity of such assumptions.

To conclude, SE and RFE are less of substitutes but more of complements to each other. Both structural and experimental types of work are called for in the production of scientific knowledge. SE is best for generating a model with intelligible interpretations while RFE is useful in exploring subject matters with little prior research as well as testing the strength of established theoretical assumptions.

References

Keane, Michael P., “Structural vs. Atheoretic Approaches to Econometrics," *Journal of Econometrics*, May 2010, 156 (1), 3-20.

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