

Problem Set #1

MACS 40200, Dr. Evans

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January 14, 2019

The Case for Structural Estimation

Structural estimation is criticized by some for using too many *a priori* assumptions based on economic theory to make causal inferences. In contrast, reduced form estimation, an alternative for structural estimation, is considered to be “simple, robust, and relatively ‘assumption free’ ” (Keane 2010) when making causal arguments. However, I believe that reduced form estimation requires as much assumptions as structural estimation. In fact, structural estimation has a comparative advantage over reduced form estimation for its interpretability of results.

Reduced form estimation require as much assumptions as structural estimation. The major difference is that structural estimation assumptions are usually explicit from economic theory; whereas, reduced from estimation assumptions are more implicit in the form of statistical assumptions. For example, reduced form estimation requires many statistical assumptions about monotonicity, homoscedasticity, measurement error, and endogeneity. Additionally, in most cases, reduced form estimation requires theoretical assumptions to make sure these statistical assumptions are met as well. For example, Keane mentions Angrist (1990) paper that uses Vietnam era draft lottery numbers as instrument to examine the effect of military service on subsequent earnings. Keane states that further assumptions are required because “randomization alone does not guarantee exogeneity” (Keane 2010). Schooling and experience which are embedded in the error term could be correlated with the instrument (Keane 2010). In fact, for reduced form models, critics can always ask if there is an endogeneity issue in the regression model. Therefore, Keane claims that without economic assumptions about the validity of the instrument, proper interpretation of inferences cannot be made (Keane 2010). Given that both structural estimation and reduced form estimation require as much assumptions, what makes structural estimation more valuable than reduced form estimation?

Structural estimation has a comparative advantage over reduced form estimation in its ability to make causal inferences. In structural estimation, causality is built into the model. Causality is assumed in how variables are related to each other in the theory. In contrast, it is very hard to make causal inferences in reduced form estimation even with abundant assumptions. In fact, as Rust points out, the very assumption that our interested outcome can be modeled by a linear regression model may be wrong (Rust 2010). It is especially difficult to make interpretations in machine learning models, where the mechanism is not transparent.

Although causal inference can be readily made through structural estimation, we must be aware of the ability to make strong assumptions that help attain more meaningful results. In this sense, I disagree with Rust and Keane’s claim that we should focus not on the misspecification of the model, but rather on model fitness and accuracy of forecast. Model fitness can be overcome by using more variables (overfitting). Since assumptions in structural estimation are based on economic theory and

causal inference is based on such assumptions in the model, I believe it is especially important to consider the specification of the model.

In conclusion, structural estimation and reduced form estimation both require many assumptions. Therefore, structural estimation could be superior to reduced form estimation in its ability to make causal inference. However, we must not take this ability for granted and make sure that the model is based on reasonable theoretical assumptions (reasonable model specification) in order to make meaningful causal inference.

References

Keane, Micheal P., “Structural vs. Atheoretic Approaches to Econometrics,” *Journal of Econometrics*, May 2010, 156 (1), 3–20.

Rust, John, “Comments on: Structural vs. Atheoretic Approaches to Econometrics by Michael Keane,” *Journal of Econometrics*, May 2010, 156 (1), 21–24.