

# Structural Estimation Pset 1

*Timothy Schwieg*

## 1 Structural Estimation is better than reduced-form

While Structural Estimation does rely upon assumptions, particularly about the exact form of the endogeneity, it is explicit about what these are, rather than implicitly making them. The form of these assumptions is also usually economic rather than statistical. Economic assumptions are easier to evaluate *a priori* than statistical ones, as these statistical assumptions must have theory applied to them to be evaluated.

The major problem with reduced-form estimation is that it has moved its "extreme" assumptions from parametric assumptions such as function forms and distributions to implicit instrument assumptions. As Keane states, instruments can only be viewed as exogenous when viewed through the lens of some theory, so they can never be taken as "letting the data speak for itself." However these assumptions are now implicit and not as spelled out, so it can be very easy to miss that the instruments perhaps are not as powerful as they seem, as is the case of draft lotteries still being endogenous to earnings.

As Keane says on page 5, "If the work is to guide future policy, it is important to understand what mechanism was at work." That is, structural estimation serves to estimate primitives, of which there is an economic, rather than statistical interpretation. This allows for prediction to be made about future policy changes, which are not achievable by reduced-form estimation. Rust echoes this when he says "the statistical model typically cannot tell us anything about [behavioral] response[s] to hypothetical policy changes that have not yet occurred." Only structural techniques are invariant to the Lucas Critique.

Structural Estimation builds Causality into the model, rather than trying to infer it "from the data." It is explicit where the assumptions are made to derive this causality, rather than implicitly made, such as monotonicity, or homogeneity among the population. While this does lead to mis-specification error, that problem is not removed by changing to the often-linear reduced form estimations used by many economists. Even strongly non-linear reduced form models such as gradient boosting and random forests suffer from mis-specification error.

## 2 However, it is not free from problems related to Instruments

Structural estimation, particularly in the empirical IO literature is quite reliant on the use of Instrumental variable estimation. This is due to both simultaneity problems as well as signaling aspects such as unobserved quality being correlated with price. Keane especially treats assaults upon instruments as assaults upon reduced-form econometrics, but these techniques are used within structural models as well.

The empirical IO literature is especially known for its use of bad instruments, ones that are very difficult to treat as exogenous. The famous Hausman instruments in particular are difficult to believe in. They require the different markets to be close enough that they are using the same distribution networks, and thus will be correlated on cost, but different enough that there can be no common shocks to demand causing the price changes. I find this extremely hard to believe, particularly in their initial application: beer sales. Neither side seems able to address the fact that some of the problems that they lay at the feet of reduced-form estimation come from structural estimation being done poorly.