New Empirical IO Handout

General

The NEIO model is an econometric model of an industry. Generally, there can be as few as one equation (the pricing relation) or a multitude of equations, representing demand (an equation or a system of equations), costs (or a system of cost and related factor demand/share equations), and a system of pricing equations (one for each firm in the data). For illustration purposes, I focus on a model with a single inverse demand equation for a homogeneous product and a pricing relation thought to hold for two firms in a market.

General Model

The general model consists of two equations. The inverse demand equation and the pricing relation.

Let inverse demand be given by

$$P_t = P_t(\sum_i q_{it}, X_t^D)$$

where P_t, $q_{it,}$ *and* X_t^D are the price at time t, the quantity produced by firm i at time t, a vector of demand shifters at time t, and an error term. Note that in this demand specification (written in general form) the form of the cost function may change over time, the product is homogeneous i.e., the quantities enter as a sum, there is a set of demand shifters that are not indexed by the firm, and there is an error term. The endogenous variables are prices and quantities. The exogenous variables are the set of demand shifters.

Let the pricing relation be given by:

$$P_t = MC_{it}(q_{it}, w) - \frac{\partial P(Q, X_t^D)}{\partial Q} q_{it}\,\theta$$

where *MC(.)*is the marginal cost equation, $\frac{\partial P(.)}{\partial Q}$ is the slope of the inverse demand equation, and θ is the markup parameter. Now then, in this equation Q, q, and P are the endogenous variables theoretically.

The goal in estimation is to obtain estimates of the demand function, marginal cost function and θ. Econometric implementation is the next section.

Econometric Implementation

The goal in estimation is to obtain estimates of the demand function, marginal cost function and θ . There are several procedures to perform the estimation. The peculiars depend on specification of the model. Recall, that an econometric model consists of a mathematical representation of the economic model, variable properties and error properties. Here I focus on the representation of the economic model and identification issues that may arise. The key point is that identification of the markup parameter can be impeded by functional form choices, but can be ameliorated by judicious choice of functional forms and specification.

Motivating example is of linear demand and marginal costs: Let the empirical model of demand be given by:

$$P = a + bQ + cX^D + e$$

and the linear model of marginal costs be given by:

$$MC = d + eq + fw + e$$

The pricing relation then becomes:

$$P = d+eq+fw - bq\theta + e$$

Note that a, b, c, d, e and f and θ are the parameters of the model to be estimated. The demand variable parameters a, b and c can be identified by estimating the demand model (using w as an instrument for Q). Let a*, b*, c* be those estimates.

In the pricing relation, you have

$$P = d + eq + fw - bq\theta$$

This can be rewritten as

$$P = d + (e-b\theta)q + fw$$

Note: in this equation, neither e nor θ can be separately identified. That is, b is identified by the demand equation, but even with this information there is no way to identify e and θ separately.

This example, illustrates an identification problem which can be encountered. Further it reinforces the role of demand and costs in identifying the markup parameter. That is, both supply and demand are necessary to identify θ.

Solutions (specific to the example above)

1. A more complete demand specification might be explored.

   $P = a + bXQ$

   In this case the derivative is given by

   $dp/dq = bX$

   The pricing relation becomes:

   $P = d+eq+fw - bqX\theta + e$

   Note: now given an estimate of b from the demand equation (note again the dependence on the demand equation), d, e, f, and θ can be identified by estimating this pricing relation. The reason this works is that unlike the previous example wherein mc and θdp/dQ were perfectly correlated, it is unlikely that q and qx are perfectly correlated.

2. Assume that there are constant returns to scale i.e., e=0. Then the pricing relation is

   $P = d + fw - bq\theta$

   And given estimates of b from the demand equation, d, f and θ can be identified from the pricing relation.

3. Add a cost function. In such cases, d, e, and f can then be identified from the estimates of a cost function (note we must then estimate costs), and given estimates from the demand equation θ can be identified. There are not many studies that have added a cost equation to the specification.

Summing Up

This is a short introduction to the NEIO model and the issues of identification. The example provided and the solutions are only one of several difficulties one can run into in implementing the model.