14.661: Recitation 9

Chris Walters

November 12, 2010

1 Borjas (2003)

Borjas' 2003 paper attempts to estimate the effects of immigration on natives' labor market outcomes. The central regressions in his paper are of the form:

$$y_{ijt} = \theta p_{ijt} + s_i + x_j + \pi_t + (s_i \times x_j) + (s_i \times \pi_t) + (x_j \times \pi_t) + \phi_{ijt},$$

where i indicates an educational level (of which there are 4), j indicates an experience level (of which there are 8), and t indicates a time period (1960,1970...2000). y_{ijt} is the mean of some outcome for natives in cell ijt, and

$$p_{ijt} = \frac{M_{ijt}}{M_{ijt} + N_{ijt}}$$

where M_{ijt} is the number of foreign-born workers in cell ijt and N_{ijt} is the number of native born workers. Essentially, this is a regression of natives' labor market outcomes on the immigrant share of the labor force in the sample of education-experience-time cells, controlling non-parametrically for education, experience, and time as well as second-order interactions between these three variables.

1.1 Understanding the strategy through an example

It's important to clarify the basis of Borjas' identification strategy, and what assumptions are necessary for it to work. Let's consider a simpler example with only 2 groups of each type: $i \in \{HS, Col\}$, $j \in \{lowexp, highexp\}$, $t \in \{1980, 1990\}$. Furthermore, let's suppose that there was a large influx of low-skilled, low-experience immigrants in 1990, and few immigrants of any type in any other group or time period. The analogue of Borjas' strategy in this simplified example would be to run the regression:

$$y_{ijt} = \theta T_{ijt} + \alpha_i + \beta_j + \gamma_t + \omega_{ij} + \kappa_{jt} + \mu_{it} + \epsilon_{ijt} \ ,$$

where

$$T_{ijt} = 1\{i = HS\} \cdot 1\{j = lowexp\} \cdot 1\{t = 1990\}$$

θ is our estimate of the treatment effect. How do we interpret this regression? By straightforward algebra, it is easy to show that in this model,

$$\theta = \{(E[y|HS, lowexp, 1990] - E[y|HS, lowexp, 1980]) - (E[y|HS, highexp, 1990] - E[y|HS, highexp, 1980])\}$$
$$-\{(E[y|Col, lowexp, 1990] - E[y|Col, lowexp, 1980]) - (E[y|Col, highexp, 1990] - E[y|Col, highexp, 1980])\}$$

This is a differences-in-differences-in-differences (DDD) estimator. For intuition, first consider just the top line. This is a DD estimator that compares the change in wages for the treatment group (low experience, high school workers) from the pre to the post period to the change in wages for high experience high school workers. That is, it is a DD estimator using high-experience low-schooling workers as the control group for low-experience low-schooling workers.

When will this DD estimator consistently estimate the causal effect of the immigrant influx? As usual, DD will be consistent when the parallel trends assumption is satisfied: In the absence of the treatment, wages of high and low-experience HS workers would move in parallel. There cannot be anything besides immigration causing differential movements in the wages of high-experience workers relative to low-experience workers for high school graduates.

This assumption may not be satisfied. The DDD estimator uses a second group, highly educated workers, for whom no one is treated; for this group, the difference in trends can be estimated. This is the second line. The DDD estimator removes this difference in trends for highly educated workers from the DD estimator for low-schooling workers. The identifying assumption becomes that anything causing differential changes in wages for workers of different experience levels must be common to both high school and college workers. To put it another way, there is no change making low experience workers with low schooling do especially badly relative to high experience workers with low schooling; "especially" means worse than low experience college grads relative to high experience college grads.

1.2 The Borjas estimator: Discussion

Borjas' regression is just a generalized version of this DDD estimator. He has many time periods, schooling groups, and experience groups rather than just two of each. Furthermore, every group is "treated" to some extent; there are at least some immigrants in every cell. Borjas parameterizes the immigration effect with a single linear term in the immigrant employment share, and finds that immigration substantially reduces wages and employment for natives.

Despite these extensions, the intuition is the same as it was for the DDD estimator. Borjas' estimator looks at experience-schooling groups who experienced large changes in immigrant share over time, and uses workers of the same schooling level and differing experience as the control group; it uses other groups of workers to estimate secular changes in the experience profile over time that could bias this comparison. The identifying assumption is still essentially that any difference in trends between experience groups is constant across schooling groups. At the very least, any failures of this assumption must be orthogonal to immigration.

1.3 Is this plausible?

What do you think? One thing I would note is that Card and Lemieux (2001) have a seminal paper analyzing the fact that there has been a major "flattening out" of the age-college premium profile over time (not that different from the experience-earnings profile). This entire paper is written without reference to immigration. The point of this observation is that the labor market has changed a lot over the period in question, and some of these changes have generated major shifts in the experience premium for some schooling groups vs. others. It seems likely that something like this could be driving some of the results that Borjas finds.

1.4 Borjas' procedure and IV

Fundamentally, Borjas' paper is about the slope of the labor demand curve. If this curve is downward sloping, immigration should lower wages for substitutable natives. One can therefore think of Borjas' estimate as the "reduced form" of a structural problem, where the parameter of ultimate interest is the labor demand elasticity. The instrument is p_{ijt}, which is assumed exogenous conditional on controls for the schooling and experience profiles. To put it simply, immigration is a supply shift that traces out the demand curve; the relationship between immigration and wages is a reduced form way of looking at the structural relationship between labor supply and wages as we move along the labor demand curve.

Borjas gets at this in a needlessly confusing way. Essentially, the structural parameter of interest is:

$$\epsilon \equiv \frac{d \log w}{d \log L}$$

(This is the inverse of the usual labor demand elasticity, but this is how Borjas defines his "wage elasticity;" I will follow his notation.) Note that we can write

$$\epsilon = \frac{d \log w}{dp} \cdot \frac{dp}{d \log L}$$

The first term here is the "reduced form" effect that Borjas estimates. The second term is the inverse of the effect of an increase in the immigrant share on the size of the labor force; this is like a theoretical first stage. To work this out, note that

$$\log L = \log(M + N) = \log\left(N\left(1 + \tfrac{M}{N}\right)\right)$$

$$\approx \log N + m, \text{ where } m = \frac{M}{N}$$

If we assume that the labor force is approximately unchanged when immigrants show up,

$$\frac{d \log L}{dp} \approx \frac{dm}{dp};$$

this is why Borjas (confusingly) defines his wage elasticity as

$$\epsilon = \frac{d \log w}{dm}$$

Working out the inverse of the theoretical first stage, we have that

$$p = \frac{M}{M+N} = \frac{1}{1 + 1/m}$$

$$= \frac{m}{1+m}$$

so

$$\frac{dp}{dm} = \frac{1}{(1+m)^2}$$

so

$$\epsilon = \frac{d \log w}{dp} \cdot \frac{dp}{dm}$$

$$= \frac{\theta}{(1+m)^2}$$

This is why Borjas' elasticity estimates are a version of 2SLS; he basically just works out the first stage from theory. Using this procedure, Borjas estimates ϵ's on the order of -0.5 to -1.

14.661 Labor Economics I
Fall 2010