Empirical Research on Economic Inequality
The effect of unions – distributional decompositions

Maximilian Kasy

Harvard University, fall 2015

Decreasing unionization since the 1980s

- Union wages: higher and less unequal
- Thus: declining unionization
  $\Rightarrow$ increase in inequality?
- Just compare wages of union / non-union members?
- Problem: two groups might be different, in terms of
  - age,
  - education,
  - gender,
  - ethnicity,
  - sector of the economy,
  - state of residence,
  - ...
- Want to compare people who look similar along all these dimensions!

Distributional decompositions

Hypothetical questions of the form:

- What if
  1. distribution of demographic covariates
     had stayed the same,
  2. distribution of wages
     given demographics and union membership status
     had stayed the same, but
  3. we consider actual historical changes of union membership
     given demographics.
- How would the distribution of wages have changed?
- i.e., to what extent is de-unionization responsible for the rise in inequality?

Setup

- Observe repeated cross-sections
  of draws from the time t distributions P^t.
- Variables (Y, D, X)
  - Y: outcome, e.g., real earnings
  - X: demographic covariates, e.g., age, gender, ...
  - D: binary "treatment," e.g., union membership
- Effect of historical changes in D
  on the distribution $P(Y)$?
- In particular, on statistics $\nu(P(Y))$?
- Examples for ν: mean, variance, share below the poverty line, quantiles, Gini coefficient, top income shares, ...

Probability reminder

Let $p(y, x)$ denote a joint probability density.

1. Conditional distribution:

$$p(Y|X) = \frac{p(Y, X)}{p(X)}$$

2. Marginal distribution:

$$p(Y) = \int p(Y, X) dX$$

3. Thus:

$$p(Y) = \int p(Y|X) p(X) dX$$

4. Similarly (law of iterated expectations):

$$E[Y] = E[E[Y|X]]$$

Counterfactual distribution

- Two distributions $P^0(Y, D, X)$, $P^1(Y, D, X)$ (beginning and end of historical period)
- What would the wage distribution $P^*(Y)$ be, assuming
  1. dist of demographics stayed the same,
  2. dist of wages given demographics, union membership stayed the same
  3. actual historical change of union membership

$$\begin{aligned} P^*(X) = & \quad P^0(X) \\ P^*(Y \leq y | X, D) = & \quad P^0(Y \leq y | X, D) \\ P^*(D|X) = & \quad P^1(D|X). \end{aligned}$$

- Get the counterfactual distribution $P^*(Y)$:

$$P^*(Y \leq y) := \int_{X,D} P^0(Y \leq y | X, D) dP^1(D|X) dP^0(X).$$

Rewriting the counterfactual distribution

1. Multiply and divide the integrand by $P^0(D|X)$.
2. Rewrite the probability $P^0(Y \leq y|X, D)$ as an expectation $E^0[\mathbf{1}(Y \leq y)|X, D]$.
3. Give the fraction $P^1(D|X)/P^0(D|X)$ a new name: $\theta(D, X)$.
4. Pull θ into the conditional expectation.
5. Use the “law of iterated expectations” to get an unconditional expectation.

Questions for you

Execute these steps, and see what you get!

Solution

$$\begin{aligned}
P^*(Y \leq y) &= \int_{X,D} P^0(Y \leq y|X,D)\frac{P^1(D|X)}{P^0(D|X)}P^0(D|X)P^0(X)dDdX \\
&= \int_{X,D} E^0[\mathbf{1}(Y \leq y)|X,D]\theta(D,X)P^0(D|X)P^0(X)dDdX \\
&= E^0[E^0[\mathbf{1}(Y \leq y)\cdot\theta(D,X)|X,D]] \\
&= E^0\left[\mathbf{1}(Y \leq y)\cdot\theta(D,X)\right],
\end{aligned}$$

where

$$\theta(D,X) := \frac{P^1(D|X)}{P^0(D|X)}.$$

Questions for you

Interpret this representation of the counterfactual distribution.

Estimation

- Suppose X is discrete.
- Let $N^t(d,x)$ be the number of observations in period t with $D = d$, $X = x$,
- similar for $N^t(x)$.
- Then we can estimate $\theta(d,x)$ as

$$\widehat{\theta}(d,x) = \frac{N^1(d,x)}{N^1(x)} \Big/ \frac{N^0(d,x)}{N^0(x)}.$$

- Estimate $P^*(Y \leq y)$ as

$$\sum_i \mathbf{1}(Y_i \leq y) \cdot \widehat{\theta}(D_i, X_i) \Big/ \sum_i \widehat{\theta}(D_i, X_i),$$

where the sums are over all observations in period 0.

Questions for you

Implement this in Stata!
(Section)

References

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