Method: Model Selection (h): vc_bw and and vc_bwalt

Non/semi-parametric model are sensitive to choice of bandwidth “h” (less so to the choice of Kernel function). The process implies a trade-off between variance and bias. The commands vc_bw (Newton-Rapson) and vc_bwalt (Nelder-Mead) can be used to select the appropriate bandwidth by minimizing the following function:

\[ CV_{bw}(h) = \frac{1}{n} \sum \left( y_i - X_i \beta(h) - (X - z)X' \delta(z,h) \right)^2 + K \frac{(z - x)}{h} \]

Note:
- By default, \( \hat{\beta}(z,h) \) is estimated at every step for all possible values of z. To increase speed process, use knots(\#), and request fewer number of regressions to be estimated.
- The CV procedure is performed over equal width blocks of z and block average.
- The LOO errors use cv_regress, using the leverage statistic for the localOLS.

Method: Model Estimation vc_reg and vc_bsigreg

The estimation of the model can be obtained focusing on specific points of reference over z. Syntax:

\[ vc_{reg} \text{varlist}, \text{vcoeff(z)} \text{[bw() kernel() knote()] robust ho2 ho3} \] (BS options)

Note:
- If not specified bw() kernel(kfunc) are taken from vc_bw/ vc_bwalt
- k(*) indicates a fixed number of equidistance points for the estimation of the models
- klist(numlist) indicates specific points for the estimation of the models
- Weights estimation uses gwaverage. kweight(=k()()
- vc_reg reports SE from OLS (interventions or robust not used) (Li & Racine,2010).
- vc_bsigreg reports Bootstrapped SE, similar to npregress.

Method: Model prediction and Evaluation

This command can get predictions, predictions of LOO errors (For CV), and predictions of Leverage (Degrees of Freedom). Also reports E(kobs) and R2

\[ CV = \frac{1}{n} \sum \left( y_i - X_i \beta(h) - (X - z)X' \delta(z,h) \right)^2 + K \frac{(z - x)}{h} \]

\[ DF = \sum \text{degrees of freedom} \]

E(kobs) = \( 1 - \frac{R2}{R2_{lms}} \)

\( R2_{lms} = 1 - \frac{\text{SSRes}}{\text{SST}} \)

Specification test compare the Semi parametric model to:

\[ y = \beta x + \epsilon \]

Using F test. \( F = \frac{\text{SSReg}(\text{df}_{\text{Reg}})}{\text{SSE}(\text{df}_{\text{Res}})} \]

Method: Model Visualization

When more than 1 point of reference is used with vc_reg, vc_graph can visualize main coefficients \( \beta(z) \), or their changes \( \delta(z) \)

Syntax:

\[ vc_{graph} \text{[selected varlist]}, [ci()] constant \text{delta xvar}(h(z)) \text{graph(name)} \]

vc_graph plots the coefficients of the selected variables. Each graph is stored in memory with the name “graphh”.

Note:
- xvar(.) can change the scale of the running variable for the Graph. Say H(z) = log(z).
- H(z) can display the figure in log scale. Uses vc_xtoy.
- Useful if CV and model estimation is done for a transformation of z.
- \( \beta \) = P(z) may help where z is sparse.

Illustration: Citations and fines (DU)