Endogeneity Exercise

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MBFZ05 Research Methodology

March 2024

Instrumental Variables Exercise

A simple equation relating the interest rate spread (T10Y3M) to the inflation rate (CPIAUCSL) is

$$T10Y3M_t = \beta_0 + \beta_1 \text{CPIAUCSL}_t + u_t.$$

(i) Estimate this equation by OLS, omitting the first time period for later comparisons. Report the results in the usual form.

(ii) Given that CPI might mismeasure the true rate of inflation, re-estimate the equation from part (i) using CPIAUCSL lagged by one period as an IV for CPIAUCSL. Compare the IV estimate of β_1 with the OLS estimate.

Instrumental Variables Exercise

(iii) Now, first difference the equation:

$$\Delta T10Y3M_t = \beta_0 + \beta_1 \Delta \text{CPIAUCSL}_t + \Delta u_t.$$

Estimate this by OLS and compare the estimate of β_1 with the previous estimates.

(iv) Discuss the possibility of using $\Delta \text{CPIAUCSL}_{t-1}$ as an IV for $\Delta \text{CPIAUCSL}_t$ in the differenced equation. Are they sufficiently correlated?

2SLS: Interest Rate Spread and Economic Activity

(i) Propose a model where the interest rate spread (T10Y3M) is potentially endogenous with respect to real GDP (GDPC1). Identify a suitable instrument for T10Y3M.

(ii) Estimate the effect of T10Y3M on GDPC1 using 2SLS, with the chosen instrument. Discuss the validity of the instrument.

(iii) Perform a test for endogeneity of T10Y3M in the GDP equation. What do the results imply about the causal relationship between the interest rate spread and GDP?

PSM: Analyzing the Effect of High Unemployment on Interest Rate Spread

(i) Define a binary treatment variable based on the unemployment rate (UNRATE), where treatment indicates a high unemployment period. Determine an appropriate threshold for defining high unemployment.

(ii) Estimate propensity scores using relevant covariates and perform matching to create a comparable control group.

(iii) Evaluate the effect of high unemployment on the interest rate spread (T10Y3M) using the matched sample. Report the Average Treatment Effect (ATE) or Average Treatment Effect on the Treated (ATT).

Heckman Correction: Industrial Production and Interest Rate Spread

(i) Suppose the observation of industrial production (INDPRO) is subject to selection bias. Specify a selection equation that models the likelihood of observing INDPRO.

(ii) Use the unemployment rate (UNRATE) as an exclusion restriction in the selection equation. Justify its inclusion.

(iii) Apply the Heckman two-step estimator to correct for selection bias when estimating the relationship between INDPRO and the interest rate spread (T10Y3M).

(iv) Interpret the significance of the inverse Mills ratio in the outcome equation.