

1. Экзамен 21 декабря в 13:00 (до 16:00)
2. 15 декабря - книгу
3. 1 дек - дедлайн г/з 2.
4. В дек - г/з 3 \oplus бонус. г/з
5. До 6 дек - обьевки гарн, кога:

- переписать?
(речи и м.)
- написать 1 любой книгу, прочитав.
 - но + приложение
 - написать неограниченное число книжек, прочитанных по указанной теме приложением
 - написать к/p, прочитав. по указанной теме

N1

$$y = X\beta + u$$

a) $\operatorname{plim}_{n \rightarrow \infty} \hat{\beta} = \operatorname{plim}_{n \rightarrow \infty} (X^T X)^{-1} X^T y =$

$$= \operatorname{plim}_{n \rightarrow \infty} (X^T X)^{-1} X^T (X\beta + u) = \beta \oplus$$

$\oplus \operatorname{plim}_{n \rightarrow \infty} \left(\frac{X^T X}{n} \right)^{-1} \frac{X^T u}{n} = \beta + \operatorname{plim}_{n \rightarrow \infty} \left(\frac{X^T X}{n} \right)^{-1} \cdot$

$\cdot \operatorname{plim}_{n \rightarrow \infty} \frac{X^T u}{n} = \beta$

$\rightarrow \operatorname{IE} (X^T u) = 0$
(но $\beta \neq 0$)

$$\overline{\mathbb{E}(u_i | X) = 0} \Rightarrow \left\{ \begin{array}{l} \mathbb{E}(u_i) = 0 \\ \mathbb{E}(u_i x_i) = 0 \\ \text{cov}(u_i, x_i) = 0 \end{array} \right. \quad \overline{\mathbb{E}(\mathbb{E}(R|L)) = \mathbb{E}(R)} \\ \text{tower property}$$

$$4) \mathbb{E}(u_i | X) = 0$$

$$\mathbb{E}(\mathbb{E}(u_i(X))) = \mathbb{E}(0)$$

$$\mathbb{E}(u_i) = 0$$

$$2) \quad \mathbb{E}(u_i x_i) = \mathbb{E}(\mathbb{E}(u_i x_i | X)) =$$

$$\uparrow = \mathbb{E}(x_i \underbrace{\mathbb{E}(u_i | x)}_{=0}) = 0$$

$$3) \text{ cov}(u_i, x_i) = \mathbb{E}(\overset{\circ}{u_i} \overset{\circ}{x_i}) - \mathbb{E}(\overset{\circ}{u_i}) \mathbb{E}(\overset{\circ}{x_i}) = 0$$

N2 Forderung 2: $E(u_i | X) \neq 0$

$$\text{Cov}(x_i^j, u_i) \neq 0$$

стремится к эволюции:

a) нронюнг. кепен.

8) Ошибки измерений

1

a) $y_i = \beta x_i + u_i$

$$\mathbb{E}(u_i | X) \neq 0$$

$$\hat{y}_i = \hat{\beta} x_i$$

$$\operatorname{plim}_{n \rightarrow \infty} \hat{\beta} = \operatorname{plim}_{n \rightarrow \infty} \frac{\sum_i x_i y_i}{\sum_i x_i^2} = \operatorname{plim}_{n \rightarrow \infty} \frac{\sum_i x_i (\beta x_i + u_i)}{\sum_i x_i^2} \quad \text{=} \\ \hat{\beta} = \frac{\sum_i x_i y_i}{\sum_i x_i^2} \quad \text{=} \quad \beta + \operatorname{plim}_{n \rightarrow \infty} \frac{\sum_i x_i u_i / n}{\sum_i x_i^2 / n} =$$

$$\operatorname{scov}(x, y) = \frac{\sum_i (x_i - \bar{x})(y_i - \bar{y})}{n-1} = \beta + \frac{\frac{\mathbb{E}(x_i u_i)}{\operatorname{cov}(x_i, u_i)}}{\frac{\operatorname{Var}(x_i)}{\mathbb{E}(x_i^2)}} \neq 0$$

$$y_i = \beta_0 + \beta_1 x_i + u_i$$

$$-\bar{y} = \beta_0 + \beta_1 \bar{x} + \bar{u}$$

$$(y_i - \bar{y}) = \underbrace{\beta_1 (x_i - \bar{x})}_{x^*} + \underbrace{(u_i - \bar{u})}_{u^*}$$

b) Jiponyuz. независимые

$$y_i = \beta x_i + \underbrace{\gamma z_i}_{\tilde{z}_i} + u_i$$

$$\hat{y}_i = \hat{\beta} x_i \quad [y_i = \beta x_i + \tilde{z}_i]$$

$$y^* = \beta_1 x^* + u^*$$

$$\operatorname{plim}_{n \rightarrow \infty} \hat{\beta} = \operatorname{plim}_{n \rightarrow \infty} \frac{\sum_i x_i y_i}{\sum_i x_i^2} = \operatorname{plim}_{n \rightarrow \infty} \frac{\sum_i x_i (\beta x_i + \gamma z_i + u_i)}{\sum_i x_i^2} =$$

$$= \beta + \operatorname{plim}_{n \rightarrow \infty} \frac{\gamma \sum_i x_i z_i}{\sum_i x_i^2} + \operatorname{plim}_{n \rightarrow \infty} \frac{\sum_i x_i u_i}{\sum_i x_i^2} \xrightarrow{\frac{\operatorname{cov}(x_i, u_i)}{\operatorname{Var}(x_i)}} 0 = \\ \rightarrow \gamma \frac{\operatorname{cov}(x_i, z_i)}{\operatorname{Var}(x_i)} / \frac{\operatorname{cov}(x_i, u_i)}{\operatorname{Var}(x_i)}$$

$$= \beta + \frac{\gamma \text{Cov}(x_1, z_0)}{\text{Var}(x_1^2)}$$

$$\ln w_i = \beta_0 + \beta_1 \text{бюдж.} + \beta_2 \text{антик.рас.} + \beta_3 \text{антик.рас.}^2 + \dots + u_i$$

↑
 $y_{(gokogm)}$

Промеж. перемен. ошиб.

c) Ошибки измерения

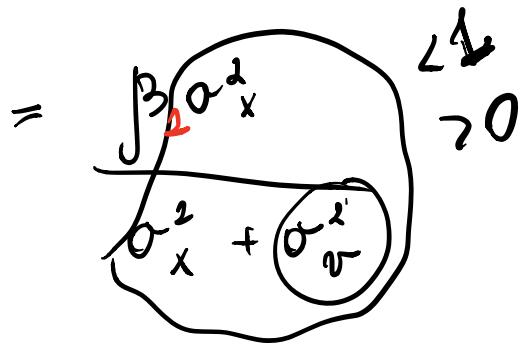
$$\underline{y_i = \beta_1 x_i + u_i + \beta_0} \quad \hat{y} = \hat{\beta}_1 x_i^* + \hat{\beta}_0$$

$$x_i^* = x_i + d + v_i$$

↑
ошибки

$$\plim_{n \rightarrow \infty} \hat{\beta}_1 = \plim_{n \rightarrow \infty} \frac{\sum_i (x_i^* - \bar{x}) y_i^* / n}{\sum_i (x_i^* - \bar{x})^2 / n} = \frac{\text{cov}(x_i^*, y_i)}{\text{Var}(x_i^*)} =$$

$$= \frac{\text{cov}(x_1 + d + v_1, \beta_1 x_1 + u_1)}{\text{Var}(x_1 + d + v_1)} = \frac{\beta_1 \text{Var}(x_1)}{\text{Var}(x_1) + \text{Var}(v_1)} =$$



N3 z_1, \dots, z_m , $m \geq k$ - инструмент.

$$1) \text{ неиз-б} \quad \text{cov}(x_i, z_i) \neq 0$$

$$2) \text{ взаимн-ст} \quad \text{cov}(z_i, u_i) = 0$$

$$\rightarrow \text{cov}(x_i, u_i) \neq 0 \quad (\text{ангол})$$

$$\text{cov}(x_i, z_i) \neq 0$$

$$\text{cov}(z_i, u_i) = 0$$

a) 2SLS $\boxed{y = X\beta + \varepsilon}$, $\underset{n \rightarrow \infty}{\text{plim}} X^T \varepsilon \neq 0$ (ангол-б)

Мод 1 $X_j = Z\gamma + u$

$$\hat{\gamma} = (Z^T Z)^{-1} Z^T X_j$$

$$\hat{X}_j = Z (Z^T Z)^{-1} Z^T X_j$$

$$\hat{X} = \begin{bmatrix} \hat{x}_1 & \dots & \hat{x}_k \end{bmatrix} \rightarrow \hat{X} = Z (Z^T Z)^{-1} Z^T X$$

$$\text{Mar 2} \quad y = \hat{X}\beta + \hat{\epsilon}$$

$$\hat{\beta}_{OLS} = (\hat{X}^\top \hat{X})^{-1} \hat{X}^\top y =$$

$$(X^\top Z (Z^\top Z)^{-1} Z^\top \cancel{Z(Z^\top Z)^{-1} Z^\top X})^{-1}.$$

$$\bullet X^\top Z (Z^\top Z)^{-1} Z^\top y =$$

$$\hat{\beta}_{OLS} = (X^\top Z (Z^\top Z)^{-1} Z^\top X)^{-1} X^\top Z (Z^\top Z)^{-1} Z^\top y$$

Z
 $n \times m, m > k$

$$n \neq m \quad m > k \quad \hat{\beta}_{OLS} = \hat{\beta}_{IV}$$

$$\hat{\beta}_W = (Z^\top X)^{-1} \cancel{(Z^\top Z)} \cancel{(X^\top Z)^{-1} X^\top \cancel{Z(Z^\top Z)^{-1} Z^\top}} y =$$

$$= (Z^\top X)^{-1} Z^\top y$$

$$\plim_{n \rightarrow \infty} \hat{\beta}_{IV} = \plim_{n \rightarrow \infty} (Z^\top X)^{-1} Z^\top y =$$

$$= \underset{n \rightarrow \infty}{\text{plim}} \quad (\bar{Z}^T X)^{-1} \bar{Z}^T (X\beta + u) = \beta + \underset{n \rightarrow \infty}{\text{plim}} \quad (\bar{Z}^T X)^{-1} \underbrace{\bar{Z}^T u}_{=0} = \\ = \beta.$$

$$X = \begin{bmatrix} X_1 & X_2 \end{bmatrix}$$

↑
exog.
↑
endog.

① Угол. энгэл. (тест Хаусмана)

$$\left\{ \begin{array}{l} H_0: \hat{\beta}_{\text{мнк}} \text{ и } \hat{\beta}_{\text{2SLS}} \text{ сист-ор} \\ H_1: \hat{\beta}_{\text{мнк}} \text{ не сист., а } \hat{\beta}_{\text{2SLs}} \text{ сист.} \end{array} \right.$$

$$(\hat{\beta}_{\text{2SLs}} - \hat{\beta}_{\text{мнк}})^T \underbrace{\left[\text{Var}(\hat{\beta}_{\text{2SLs}}) - \text{Var}(\hat{\beta}_{\text{мнк}}) \right]^{-1}}_{\text{rang} = K} \cdot$$

$$\cdot (\hat{\beta}_{\text{2SLs}} - \hat{\beta}_{\text{мнк}}) \sim \chi^2_K$$

② Переб-б инсп-б

$$X_j = Z\gamma + u \quad \left\{ \begin{array}{l} H_0: \gamma_1 = \dots = \gamma_m = 0 \\ H_1: \exists i: \gamma_i \neq 0 \end{array} \right.$$

F-тест

③ Валидность ($m > k$):

только

$$\left\{ \begin{array}{l} H_0: \underset{n \rightarrow \infty}{\text{plim}} \hat{Z}^T u = 0 \\ H_1: \underset{n \rightarrow \infty}{\text{plim}} \hat{Z}^T u \neq 0 \end{array} \right.$$

$$H_1: \underset{n \rightarrow \infty}{\text{plim}} \hat{Z}^T u \neq 0$$

$$\begin{aligned} J &\xrightarrow{\text{важно}} \text{Справке} \quad \frac{1}{\hat{\sigma}_u} \hat{u}^T \hat{Z} (\hat{Z}^T \hat{Z})^{-1} \hat{Z}^T \hat{u} \\ &\sim \chi_{m-k}^2 \quad \text{Хансен} \quad \hat{u}^T \hat{Z} (\hat{Z}^T \hat{\Omega} \hat{Z})^{-1} \hat{Z}^T \hat{u} \\ &\quad \uparrow \\ &\quad \hat{\Omega} = \begin{bmatrix} \hat{u}_1 & 0 \\ 0 & \dots & 0 \\ 0 & \dots & \hat{u}_n \end{bmatrix} \end{aligned}$$

$$\hat{\beta}$$

независим.

$$\beta$$

const

$$t = \left| \frac{\hat{\beta} - \beta_0}{\sqrt{\text{Var}(\hat{\beta})}} \right| \leq \text{crit}$$

$$\beta - \text{crit} \sqrt{\text{Var}} \leq \beta \leq \hat{\beta} + \text{crit} \sqrt{\text{Var}}$$

95%

$$H_0: \underline{\beta = \beta_0}$$

$$\hat{\beta} \stackrel{H_0}{\sim} N(\beta_0, \dots)$$

$$\hat{\beta}$$

