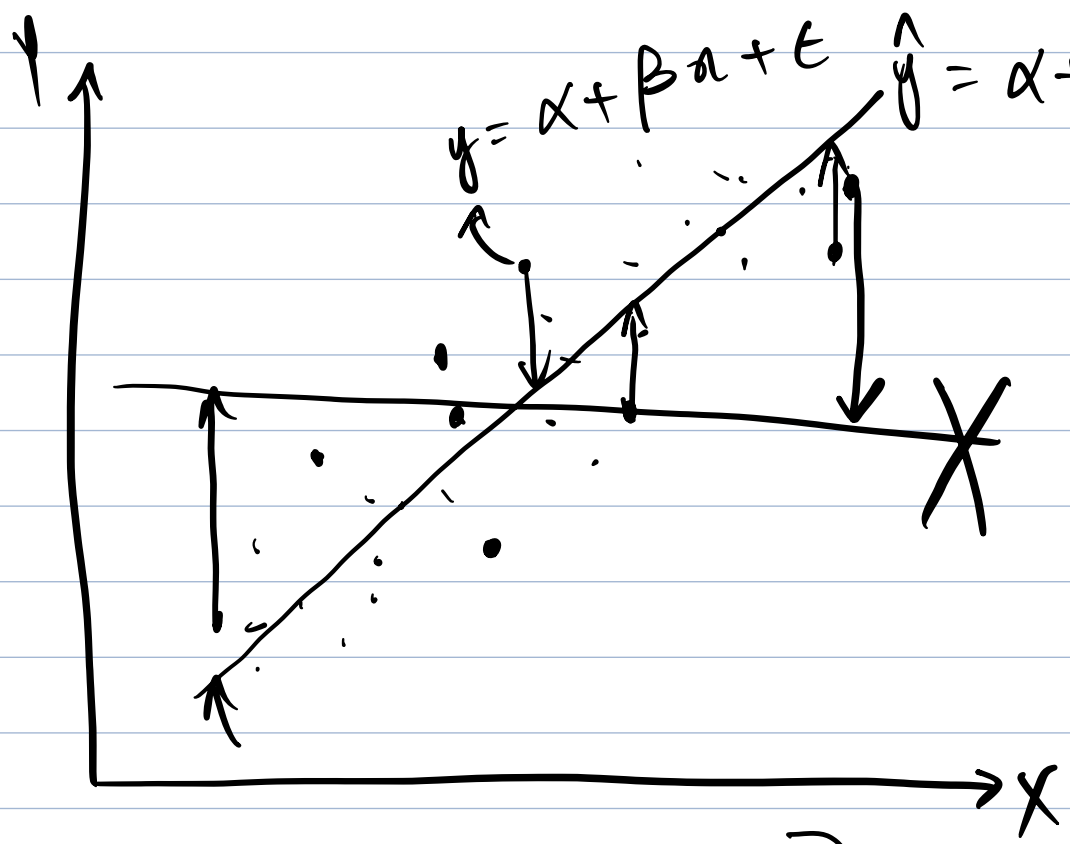


min → MIN

$\sum (y - \hat{y})^2$ → β

RES → SUM

SQUARES

OLS

WORK ⟶ SLEEP

$$SLEEP_{it} = \alpha + \beta_1 WORKTIME_{it} + \beta_2 CHILDREN_{it} + \beta_3 MARRIED_{it} + \beta_4 HEALTH_{it} + \beta_5 MALE_i + (a_i) + u_{it}$$

INC.

a_i: RACE, WORKAHOLIC etc.

u_{it}: ERRORS → LOCATION etc.

① POLS → POOLED

$$cov(\varepsilon_{it}, \varepsilon_{it-1}) \neq 0$$

② POLS WITH CLUSTERED STD. ERRORS

$\sim [i, t \quad t-1]$ $cov(\varepsilon_{it}, \varepsilon_{it-1}) = 0$

X → CROSS-SEC → B/W PPL

T ↓ TIME → REGRESS

REG,

RE : RANDOM EFFECTS.

③ RANDOM EFFECTS

✓ SAME PERSON MULTIPLE TIMES.

④ FIRST DIFF.

$$E[a_i \mid X] \neq 0$$

a_i → WORKAHOLIC

X → WORKTIME

(A) $SLEEP_{i,75} = \alpha + \beta_1 WORK_{i,75} + \dots + a_i + u_{i,75}$

(B) $SLEEP_{i,81} = \alpha + \beta_1 WORK_{i,81} + \dots + a_i + u_{i,81}$

(B) − (A) → $\beta_1 WORK_{i,81} - \beta_1 WORK_{i,75}$

$$\Delta SLEEP_i = \alpha + \beta_1 \Delta WORK_i + \ldots + \cancel{\alpha_i} + \Delta u_i$$

FD

(5) F E → EFFECTS

↘ FIXED

↓

(A) $SLEEP_{i,t} = \alpha + \beta_1 WORK_{i,t} + \ldots + \cancel{\alpha_i} + u_{i,t}$

(B) $\overline{SLEEP}_i = \alpha + \beta_1 \overline{WORK}_i + \ldots + \overline{a_i} + \overline{u}_i$

$\overline{a_i} = a_i$

MOTIVATION.

WORKALIC etc. $E[a_i | X] \neq 0$

→ X a_i

NO DATA

$$\overline{a_i} = \frac{a_{i,75} + a_{i,81}}{2}$$

$$= \frac{a_i + a_i}{2} = \frac{2a_i}{2} = a_i$$

(A) − (B) → FE

$WORK_{ME,75}$

~~$WORK_{ME,81}$~~

} $WORK_{i,t}$ ①

$$\overline{WORK_{ME}} = \frac{WORK_{ME,75} + WORK_{ME,81}}{2}$$

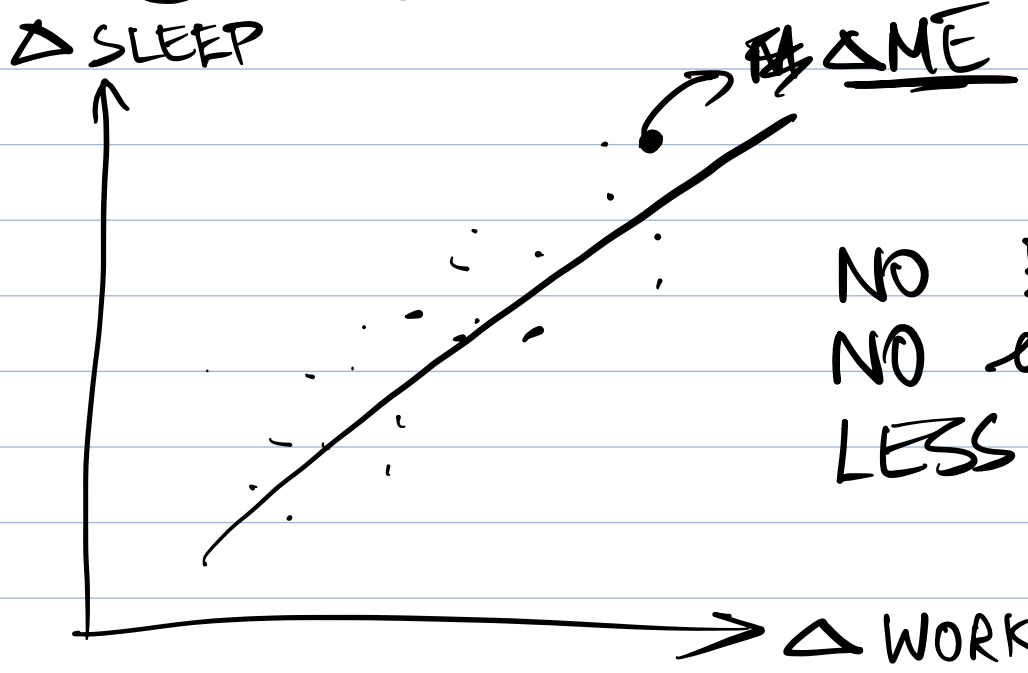
X

$$\bar{a}_i = \frac{a_{i,75} + a_{i,81}}{2}$$

$a_{i,75} = a_i$

$a_{i,81} = a_i$

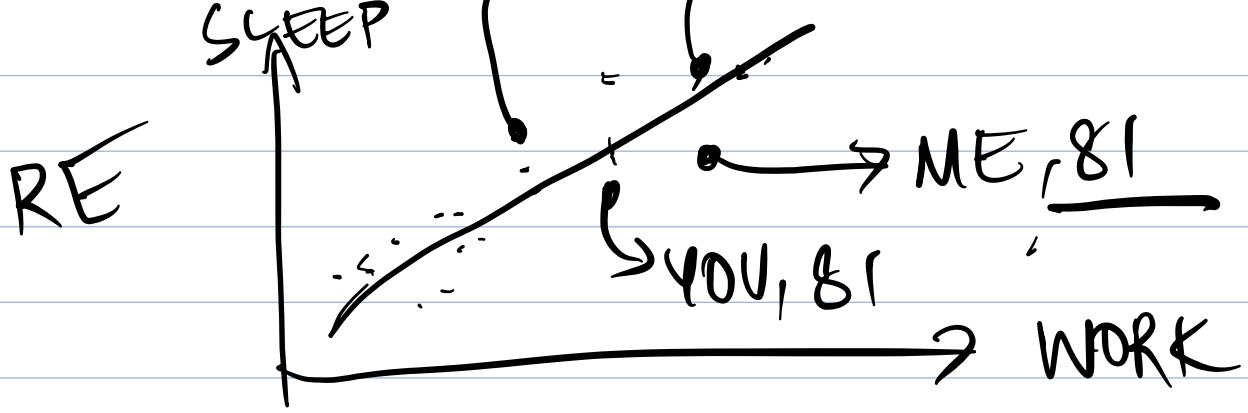
FE ② − ① →



FE.

NO BIAS
NO a_i
LESS INFO.

$YOU_{,75}$ → $ME_{,75}$



BIAS →
$E[a_i|x] \neq 0$
MORE INFO.