a) $\log(wage_i) = \beta_1 + \beta_2 Female_i + \beta_3 Age_i + \beta_4 Educ_i + \beta_5 parttime_i + \varepsilon_i$

$\beta_2 = 0$, $\beta_3 = 0$, $\beta_4 = 0$, and $\beta_5 = 0$

$$\underbrace{\begin{pmatrix} 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{pmatrix}}_{R} \underbrace{\begin{pmatrix} \beta_1 \\ \beta_2 \\ \beta_3 \\ \beta_4 \\ \beta_5 \end{pmatrix}}_{\beta} = \underbrace{\begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}}_{r}$$

b) $DE_{2i} = \begin{cases} 1 & \text{if } Educ_i = 2 \quad (\text{level } 2) \\ 0 & \text{otherwise } (\text{level } 1, 3, 4) \end{cases}$

DE_{3i} and DE_{4i}

$$\log(wage_i) = \gamma_1 + \gamma_2 Female_i + \gamma_3 Age_i + \gamma_4 DE_{2i} + \gamma_5 DE_{3i} + \gamma_6 DE_{4i} + \gamma_7 parttime + \varepsilon_i$$

The Educ. effect (on log-wage)

$1 \to 2$: γ_4

$1 \to 3$: γ_5

$1 \to 4$: γ_6

$2 \to 3$: $\gamma_5 - \gamma_4$

$2 \to 4$: $\gamma_6 - \gamma_4$

$3 \to 4$: $\gamma_6 - \gamma_5$

c) Educ. effect (on log wage)

(a)

level $1 \to 2$: β_4

$1 \to 3$: $2\beta_4$

$1 \to 4$: $3\beta_4$

(b)

or $1 \to 2$: $\beta_4 = \gamma_4$

$2 \to 3$: $\beta_4 = \gamma_5 - \gamma_4$

$3 \to 4$: $\beta_4 = \gamma_6 - \gamma_5$

$\gamma_5 - \gamma_4 = \gamma_4 \longrightarrow \gamma_5 = 2\gamma_4$

$\gamma_6 - \gamma_5 = \gamma_4 \longrightarrow \gamma_6 = \gamma_4 + \gamma_5 = 3\gamma_4$

$\underbrace{\gamma_5 = 2\gamma_4 \quad \gamma_6 = 3\gamma_4}_{g=2 \text{ restrictions}}$

$$\underbrace{\begin{pmatrix} 0 & 0 & 0 & -2 & 1 & 0 & 0 \\ 0 & 0 & 0 & -3 & 0 & 1 & 0 \end{pmatrix}}_{R} \gamma = \underbrace{\begin{pmatrix} 0 \\ 0 \end{pmatrix}}_{r}$$