**Problem 1**

**Note: Please check the appendix section for detailed results and code**

**b) Run IV and get estimates**

**Code:**

\*\*\*\* Generate the binary treatment variables\*\*\*\*\*\*

gen treat1 = 0

replace treat1 = 1 if hwage >= 5

gen treat2 = 0

replace treat2 = 1 if wage >= 7

gen treat3 = 0

replace treat3 = 1 if unemployment >= 5

\*\*\*Question b\*\*\*\*\*

\*\*\*Estimate the IV regression by running mrt on the binary treatment variables,

\*\*\*\*\* control variables and instrumental variable

ivregress 2sls mtr treat1 treat2 age heduc hsiblings (siblings= treat3)

\*\*\*\*Alternative method is to use gmm approach\*\*\*\*\*

ivregress gmm mtr treat1 treat2 age heduc hsiblings (siblings= treat3)

**Empirical Results:**

**Table 1: IV estimation**



**Alternatively:**



As we can see from table 1, the result shows that both first binary treatment (treat1) and heduc have a significant impact on mtr. Unfortunately, the result shows that the instrumental variable is insignificant to the model using IV regression.

**C) Calculate the bias based on the formula derived in part a**

**Code:**

\*\*\*\*\*Question c\*\*\*\*\*\*

reg mtr treat1 treat2 treat3 age heduc hsiblings

predict e\_z, residuals

mat beta = e(b)

svmat beta, names(matcol)

reg siblings treat1 treat2 treat3 age heduc hsiblings

predict e\_y, residuals

mat gamma = e(b)

svmat gamma, names(matcol)

scalar alpha\_hat1 = betatreat3/gammatreat3

display alpha\_hat1

reg treat3 treat1 treat2 age heduc hsiblings

predict e\_t, residuals

\* Estimate the first covariance using the second and the first residuals

corr e\_y e\_z, covariance

scalar scov1 = r(cov\_12)

\* Estimate the second covariance using the third and the first residuals

corr e\_t e\_z, covariance

scalar scov2 = r(cov\_12)

\* Finally, divide the first covariance by the second covariance.

scalar alpha\_hat2 = scov1/scov2

display alpha\_hat2

**Empirical Result:**

**Table 2: reg mtr treat1 treat2 treat3 age heduc hsiblings**

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**Table 3: reg siblings treat1 treat2 treat3 age heduc hsiblings**

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**Table 4:** **reg treat3 treat1 treat2 age heduc hsiblings**

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**Table 5:** **Estimate the covariance**







After estimating the three regression equations showed in table 2-4, the calculated bias is given as .