5.33

$$\ln(WAGE) = \beta_1 + \beta_2 EDUC + \beta_3 EDUC^2 + \beta_4 EXPER + \beta_5 EXPER^2 + \beta_6 (EDUC \times EXPER) + e$$

a.

At what levels of significance are each of the coefficient estimates "significantly different from zero"?

```
Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  1.038e+00  2.757e-01   3.764 0.000175 ***
educ         8.954e-02  3.108e-02   2.881 0.004038 **
educ2        1.458e-03  9.242e-04   1.578 0.114855
exper        4.488e-02  7.297e-03   6.150 1.06e-09 ***
exper2      -4.680e-04  7.601e-05  -6.157 1.01e-09 ***
educ_exper  -1.010e-03  3.791e-04  -2.665 0.007803 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.4638 on 1194 degrees of freedom
Multiple R-squared:  0.3227,    Adjusted R-squared:  0.3198
F-statistic: 113.8 on 5 and 1194 DF,  p-value: < 2.2e-16
```

We can see the p-value is less that 0.01, so at 1% significant level we can conclude that the coefficient is different from zero, excepted that educ^2 is 0.1148 so at 12% significant level we can conclude that the coefficient of educ^2 is different from zero.

b.

Obtain an expression for the marginal effect Eln(WAGE)EDUC, EXPER EDUC. Comment on how the estimate of this marginal effect changes as EDUC and EXPER increase.

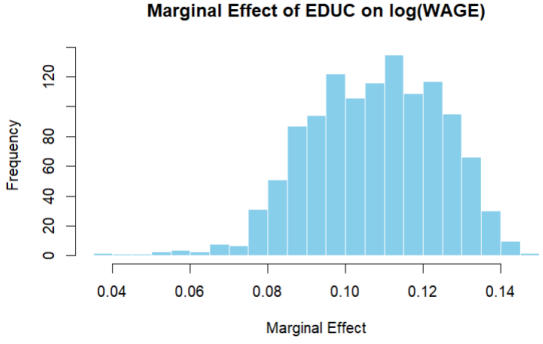
The marginal effect of educ is **beta 2+2*beta 3* educ +beta 6 * exper.**

0.08954+ 0.002916*educ - 0.001010*exper

When education increase the wage will increase, but experience increase the wage is decreased.

c.

Evaluate the marginal effect in part (b) for all observations in the sample and construct a histogram of these effects. What have you discovered? Find the median, 5th percentile, and 95th percentile of the marginal effects.




```
> quantile(marginal_educ, probs = c(0.05, 0.5, 0.95))
        5%        50%        95%
0.08008187 0.10843125 0.13361880
```

Most individuals have a positive marginal effect of education on log(wage), typically between 0.09 and 0.13. This suggests that additional years of education are generally associated with higher wages. The distribution is slightly left-skewed, and the median marginal effect is around 0.105, indicating that one more year of education increases log(wage) by about 10.5% on average.

d.

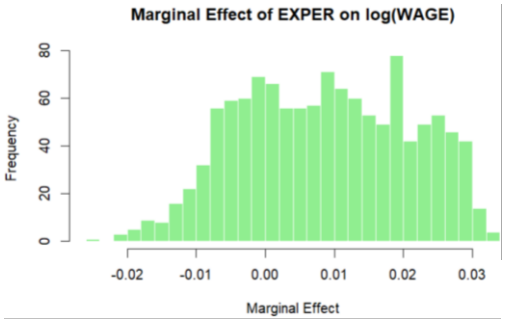
Obtain an expression for the marginal effect Eln(WAGE)EDUC, EXPER EXPER. Comment on how the estimate of this marginal effect changes as EDUC and EXPER increase.

The marginal effect on exper is 0.04488+2*-0.0004680*exper-0.001010*educ

When the exper and educ increase, the wage will decrease.

e.

Evaluate the marginal effect in part (d) for all observations in the sample and construct a histogram of these effects. What have you discovered? Find the median, 5th percentile, and 95th percentile of the marginal effects.




```
> quantile(marginal_exper, probs = c(0.05, 0.5, 0.95))
          5%          50%          95%
-0.010376212  0.008418878  0.027931151
```

The marginal effect of experience on log(wage) varies widely across individuals. While most values are positive around 0.01 to 0.02, some are negative, indicating diminishing or even negative returns to additional experience for certain people. The distribution is slightly skewed left.

f.

David has 17 years of education and 8 years of experience, while Svetlana has 16 years of education and 18 years of experience. Using a 5% significance level, test the null hypothesis that Svetlana's expected log-wage is equal to or greater than David's expected log-wage, against the alternative that David's expected log-wage is greater.

David: b1+17b2+17*17b3+8b4+8*8b5+17*8b6

Svetlana:b1+16b2+16*16b3+18b4+18*18b5+16*18b6

Difference(s-d): -b2-33b3+10b4+260b5+152b6

H0: s-d>=0 against h1:s-d<0

t-stat = 0.03588456/0.02148902=1.669902

the critical value is -1.645, 1.669902>-1.645, not reject h0, can not conclude that

David is greater.

g.

After eight years have passed, when David and Svetlana have had eight more years of experience, but no more education, will the test result in(f) be the same? Explain this outcome?

David: b1+17b2+17*17b3+16b4+16*16b5+17*16b6

Svetlana:b1+16b2+16*16b3+24b4+24*24b5+16*24b6

Difference(s-d): -b2-33b3+10b4+420b5+144b6

H0: s-d>=0 against h1:s-d<0

t-stat = -0.03091716/ 0.01499112= -2.062365

the critical value is -1.645, -2.062365<-1.645, reject h0, conclude that David is greater.

The marginal effect of experience is diminishing, so when Svetlana increase its experience, the effect is lower than David.

h.

Wendy has 12 years of education and 17 years of experience, while Jill has 16 years of education and 11 years of experience. Using a 5% significance level, test the null hypothesis that their marginal effects of extra experience are equal against the alternative that they are not. State the null and alternative hypotheses in terms of the model parameters.

Wendy: b4+34b5+12b6

Jill: b4+22b5+16b6

Difference(w-j) = 12b5-4b6

H0: w-j =0 against h1: w-j is not 0

t-stat = -0.001575327/ 0.001533457= -1.027304

the critical value is -1.96,the t-stat is greater than -1.96, we cannot reject h0, do not concluded that the marginal effect of experience is different from Wendy and jill.

I.

How much longer will it be before the marginal effect of experience for Jill becomes negative? Find a 95% interval estimate for this quantity.

Using delta method we can get exper=-(b4+16b6)/2b5

Marginal effect turns negative at EXPER = 19.6771 years

Se_exper 1.895713

95% CI for turning point: [15.9578 , 23.3964]