

# How to Calculate Confidence Interval for Regression Coefficient in R

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## RECOMMENDED CITATION

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To calculate the confidence interval for a regression coefficient in R, you need to use the `confint()` function. This function takes the fitted regression model as an argument and returns the 95% confidence interval for each of the regression parameters. The confidence interval can help you decide whether or not to accept a hypothesis about the value of the coefficient and can also be used to compare the relative importance of different coefficients in the model.

In a linear regression model, a regression coefficient tells us the average change in the associated with a one unit increase in the predictor variable.

We can use the following formula to calculate a confidence interval for a regression coefficient:

**Confidence Interval for  $\beta_1$ :  $b_1 \pm t_{1-\alpha/2, n-2} * se(b_1)$**

where:

**$b_1$**  = Regression coefficient shown in the regression table

**$t_{1-\alpha/2, n-2}$**  = The t critical value for confidence level  $1-\alpha$  with  $n-2$  degrees of freedom where  $n$  is the total number of observations in our dataset

**$se(b_1)$**  = The standard error of  $b_1$  shown in the regression table

The following example shows how to calculate a confidence interval for a regression slope in practice.

## Example: Confidence Interval for Regression Coefficient in R

Suppose we'd like to fit a simple linear regression model using **hours studied** as a predictor variable and **exam score** as a response variable for 15 students in a particular class:

Hours Studied	Exam Score
1	64
2	66
4	76
5	73
5	74
6	81
6	83
7	82
8	80
10	88
11	84
11	82
12	91
12	93
14	89

We can use the function to fit this simple linear regression model in R:

**#create data frame**

```
df <- data.frame(hours=c(1, 2, 4, 5, 5, 6, 6, 7, 8, 10, 11, 11, 12, 12, 14),
score=c(64, 66, 76, 73, 74, 81, 83, 82, 80, 88, 84, 82, 91, 93, 89))
```

**#fit linear regression model**

```
fit <- lm(score ~ hours, data=df)
```

**#view model summary**

```
summary(fit)
```

Call:

```
lm(formula = score ~ hours, data = df)
```

Residuals:

```
Min 1Q Median 3Q Max
```

```
-5.140 -3.219 -1.193 2.816 5.772
```

Coefficients:

```
Estimate Std. Error t value Pr(>|t|)
```

```
(Intercept) 65.334 2.106 31.023 1.41e-13 ***
```

```
hours 1.982 0.248 7.995 2.25e-06 ***
```

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 3.641 on 13 degrees of freedom

Multiple R-squared: 0.831, Adjusted R-squared: 0.818

F-statistic: 63.91 on 1 and 13 DF, p-value: 2.253e-06

Using the coefficient estimates in the output, we can write the fitted simple linear regression model as:

Score = 65.334 + 1.982\*(Hours Studied)

Notice that the regression coefficient for hours is **1.982**.

This tells us that each additional one hour increase in studying is associated with an average increase of **1.982** in exam score.

We can use the **confint()** function to calculate a 95% confidence interval for the regression coefficient:

```
#calculate confidence interval for regression coefficient for 'hours'
confint(fit, 'hours', level=0.95)
```

```
2.5 % 97.5 %
hours 1.446682 2.518068
```

Since this confidence interval doesn't contain the value 0, we can conclude that there is a statistically significant association between hours studied and exam score.

We can also confirm this is correct by calculating the 95% confidence interval for the regression coefficient by hand:

95% C.I. for  $\beta_1$ :  $b_1 \pm t_{1-\alpha/2, n-2} * se(b_1)$

95% C.I. for  $\beta_1$ :  $1.982 \pm t_{.975, 15-2} * .248$

95% C.I. for  $\beta_1$ :  $1.982 \pm 2.1604 * .248$

95% C.I. for  $\beta_1$ :

The 95% confidence interval for the regression coefficient is .

**Note #1:** We used the to find the t critical value that corresponds to a 95% confidence level with 13 degrees of freedom.

**Note #2:** To calculate a confidence interval with a different confidence level, simply change the value for the **level** argument in the **confint()** function.

The following tutorials provide additional information about linear regression in R:

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