Regression vs Tree based Model

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About Data

1988

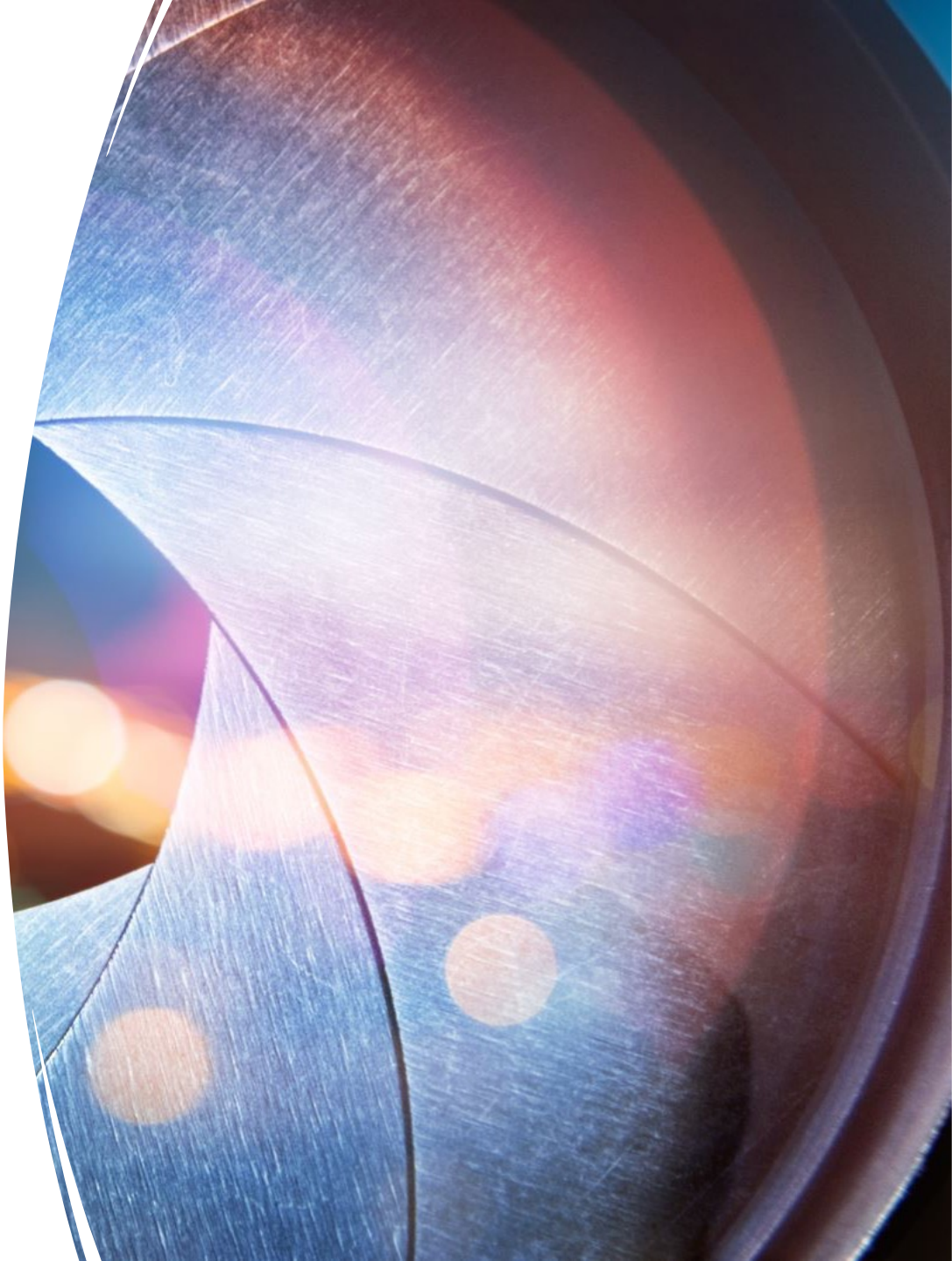
Weekly Wages for US male workers sampled from the Current Population Survey in 1988

Data frame has 2000 rows and 10 columns.

2000

OBJECTIVE

- When the dependent (goal) variable is a continuous number, it is important to understand and compare how error is quantified in OLS and tree regression.



Summary Statistics

Parameters	Wage	Education	Experience
Minimum Value	50.39	0.00	-2.00
First Quartile	308.64	12.00	8.00
Median	522.32	12.00	15.00
Mean	608.12	13.11	18.41
Third Quartile	783.48	16.00	27.00
Maximum Value	7716.05	18.00	59.00

Weekly wages

- Average wage $608.48.
- Minimum value $50.39 and Maximum value $7716.05

Education

0-18 Years

Experience

-2 may be a typo

Skewness

Wage	Education	Experience
3.7872164	-0.6967118	0.6568895

- Wage data is mostly skewed

Target/Dependent Variable

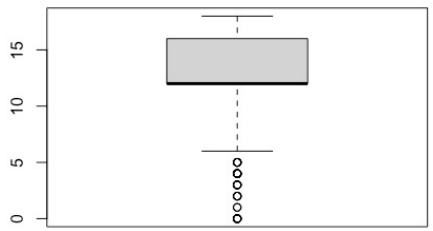
- Wage

Independent (predictor) variables

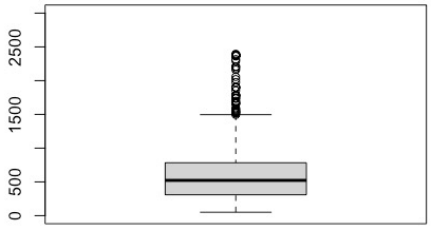
- Education
- Experience

Correlation Matrix

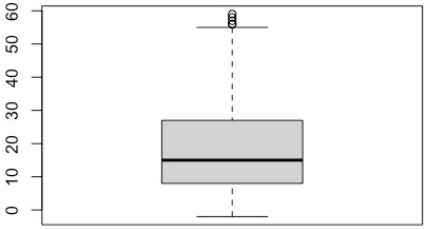
Boxplot Feature to explain skewness and distribution



Boxplot for Education



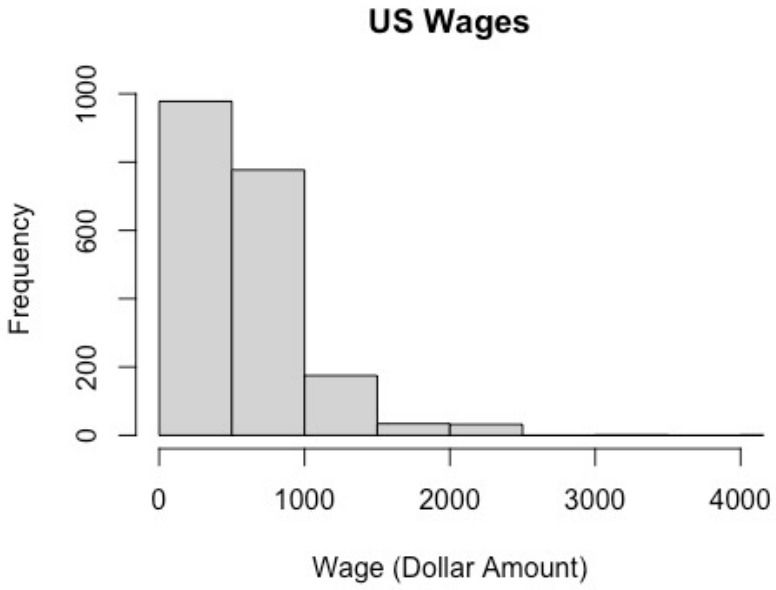
Boxplot for US Wages

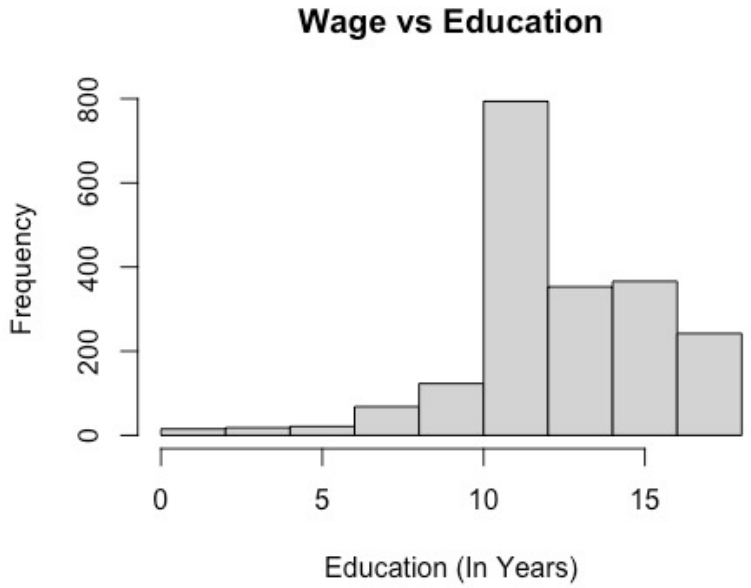


Boxplot for Experience

Histogram

Wage	Education	Experience
3.7872164	-0.6967118	0.6568895





- Wages are right skewed.
- Most people are having income in between $0-1500

- People with high school degree tend to have more wages

Scatterplot

- Hard to tell about trend
- Bucketing would be helpful to discern a pattern

With years of education, wage increases

ORDINARY LEAST SQUARES REGRESSION

Our regression model is defined in the following way:

$$\mathbf{wage} \sim -\mathbf{242.799412} + \mathbf{51.175268}(\mathbf{educ}) + \mathbf{9.774767}(\mathbf{exper}) + \epsilon$$

- With one year increase of education, there will be a raise of $51.17
- With one year increase of experience, there will be a raise of $9.77

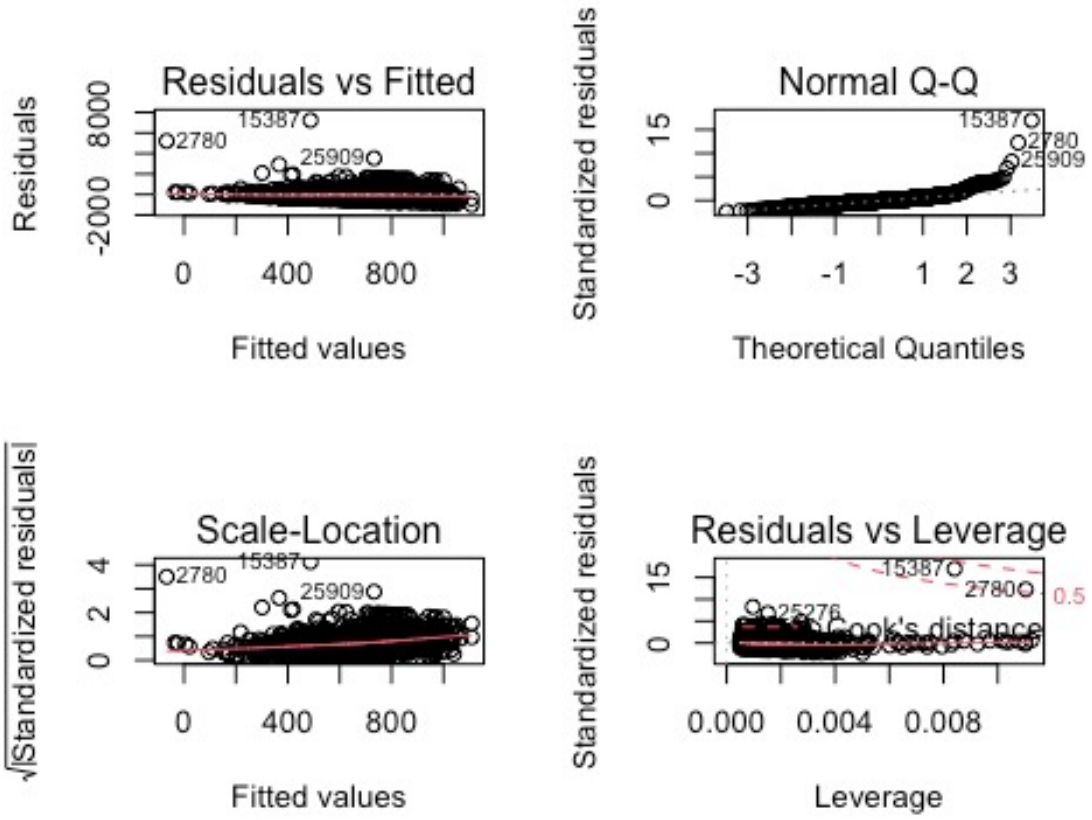
	Estimate	Std. Error	t-value	Pr(>|t|)
Intercept	-242.7994	50.6816	-4.791	1.78e-06 ***
Education	51.1753	3.3419	15.313	2e-16 ***
Experience	9.7748	0.7506	13.023	2e-16 ***

F-statistics: 156, P-value (F-statistics): $< 2.2^{x}\ 10^{-16,}$

Residual standard error: 427.9

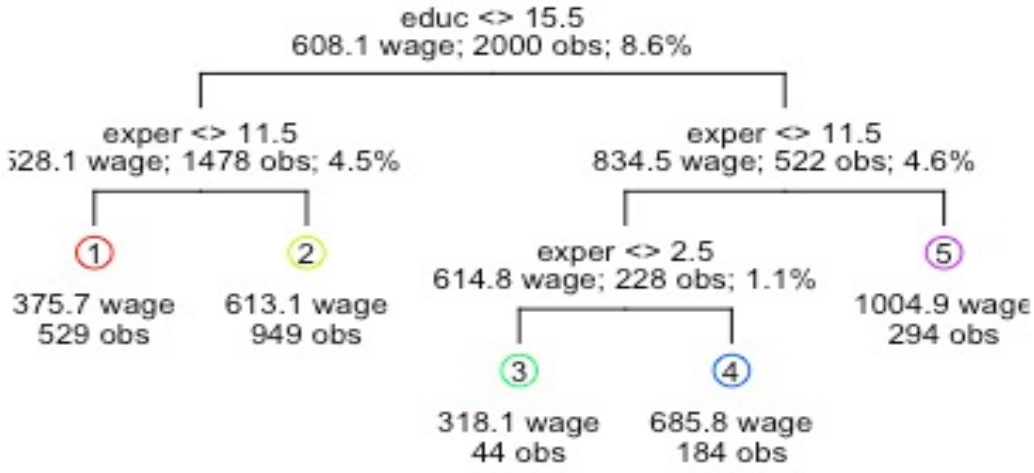
Multiple R-squared: 0.14, Adjusted R-squared: 0.13

REGRESSION MODEL ACCURACY



- Residual vs Fitted: Equally spread residuals around a horizontal line **without distinct patterns**.
- QQ plot: Data is **normally distributed** with some outliers like 15387, 2780 and 25909.

TREE REGRESSION MODEL



Sum of square errors (SSE)

- Tree model, with an SSE of 34298289, was superior at predicting weekly earnings for individuals.
- SSE 365568644 of OLS linear regression was equivalent to this model's performance.

$$SSE = \sum_{i=1}^{n} (y_i - \hat{y}_i)^2$$

Model	SSE
Regression Model	365568644
Tree Model	342982890